DEC 26 1913

JOURNAL OF ELECTRICITY

POWER AND GAS

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STATION "A," SAN FRANCISCO.

BY FRANK H. VARNEY.

INTEGRATING METERS IN EFFICIENCY TESTS.

BY C. S. HULL.

ELECTRICITY AND THE FIRE HAZARD.

BY J. H. MONTGOMERY.

DEC 27 1913

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Alphabetical Index to Advertisers, Page 8. **Where to Buy It in the West, Pages, 9, 10.**

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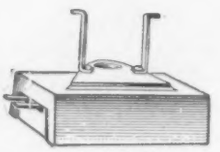
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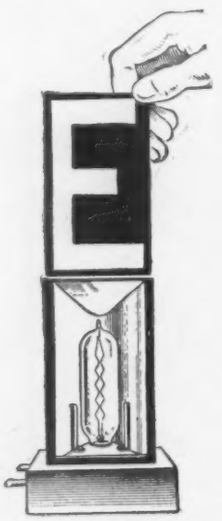
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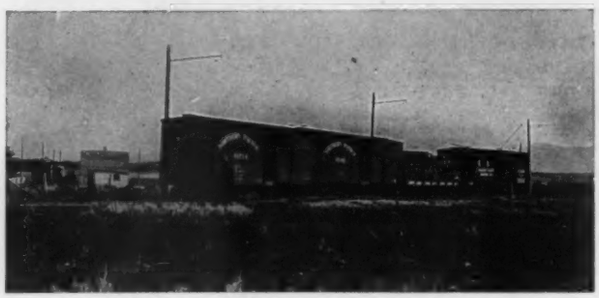
Westinghouse Church Kerr & Co. made a preliminary report upon the road and later designed, built and equipped the entire line, which is now a part of the Chicago, Milwaukee and Puget Sound system.



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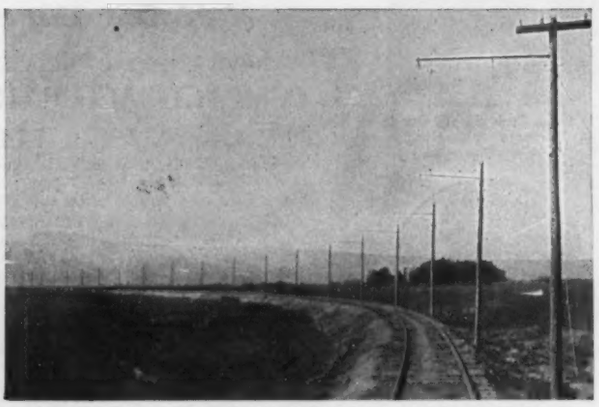

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(IN SAN FRANCISCO STOCK)

Line Voltage	27000	Diameter	8 inches
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The Locke Insulator Mfg. Co.
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Tanks of all descriptions for Water, Oil and Gas. Single and Double Well Casing

OUR SPECIALTY: Riveted Pipe for High Pressure

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The Resultant Business

comes to you, and your responsibility in the matter is to keep up your Simplex Stock, and give inquiring customers the goods they want.

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We Are Telling American Householders

That you will supply them with Simplex Electric Heating and Cooking Appliances.

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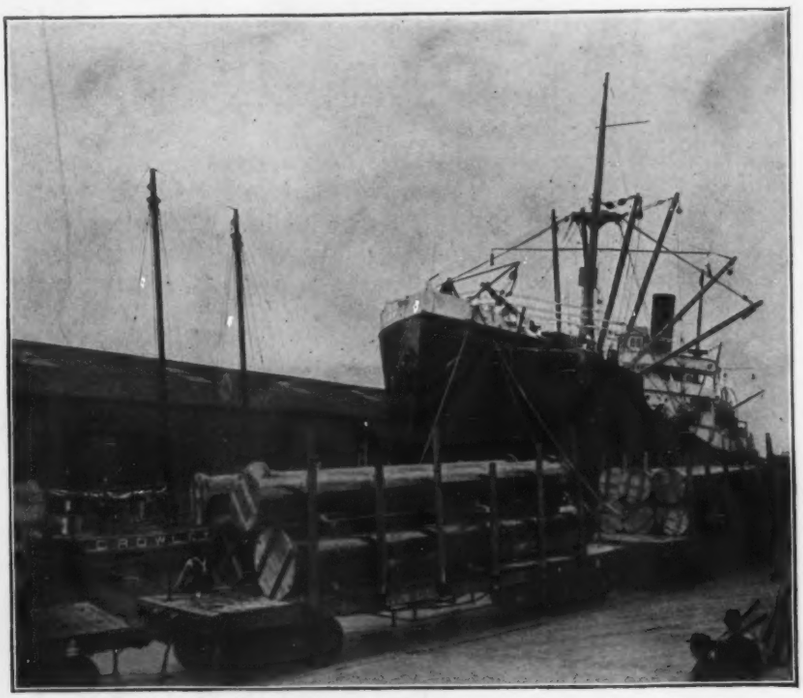

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cover the widest possible range of application, with almost ideal operating characteristics.

All forms have the inverse element feature.

Overload Only—The relay alone is instantaneous at very heavy overloads, or in connection with the torque compensator gives adjustable definite minimum time at heavy overloads. This combination of inverse time element with definite minimum time is unknown in any other type of relay.

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Protection of Parallel Feeders is fully provided by the use of reverse power only relays in the sub-station, and overload only relays in the generating station.

Protection of Series Feeders is provided by the use of overload only relays with torque compensators, thus obtaining selective action, and providing for tripping of only the breaker nearest source of trouble.

Many Special Conditions can be solved by various applications of these relays and torque compensators.

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JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXI SAN FRANCISCO, DECEMBER 20, 1913 NUMBER 25

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STATION "A"—SAN FRANCISCO DISTRICT

BY FRANK H. VARNEY.

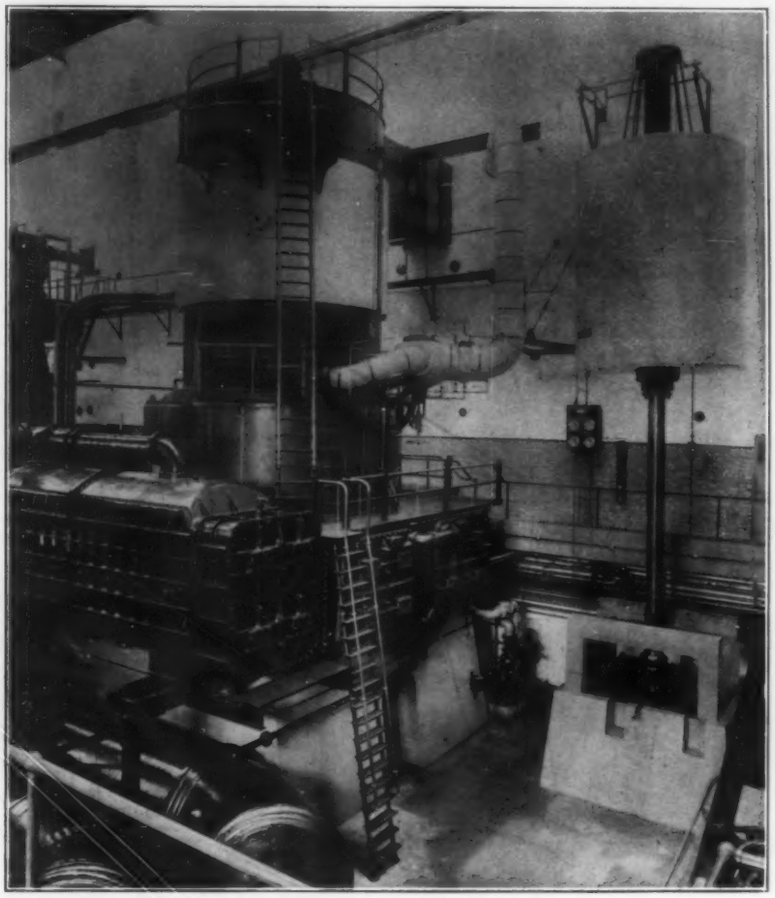
(In this article the equipment is described of the main electric generating station of the Pacific Gas & Electric Company in its San Francisco District. In this plant the prime movers of but a decade ago have been entirely replaced by turbines which double the capacity of the plant.—The Editors.)

The main electric generating station in San Francisco, known as Station "A," is located in the Potrero District and occupies an entire block on Louisiana street, from Twenty-third street to Humboldt street. The building is of massive brick construction, divided longitudinally into the engine room and the boiler room, each of which runs the full length of the building.

The original plant, which was completed in 1901, consisted of six engines and fifteen boilers. The engines were McIntosh & Seymour vertical, compound direct connected to Westinghouse generators. Five of these machines were of 1500 kw. capacity and the sixth, 500 kw.

The fifteen boilers were all Babcock & Wilcox 524 h.p. built for 200 lb. working pressure. The plant was equipped with Green Economizers and induced draft fans. As originally built, therefore, the station had a capacity of 8000 kw. in engines and 7860 boiler h.p.

In 1905 additions were made to both the engine room and the boiler room equipment. Four vertical triple expansion marine type engines were installed, two of these being direct connected to 1500 kw. generators and the other two direct connected to 3500 kw. generators. The total capacity of the station was thus increased to 18,000 kw. At the same time the boiler capacity was more than doubled by adding six 686 h.p. Babcock & Wilcox boilers equipped with superheaters, and six 541 h.p. Heine boilers, making a total capacity of 15,222 h.p. The plant remained with this equipment until 1910 and during this period the greatest load that was ever carried was approximately 21,000 kw.

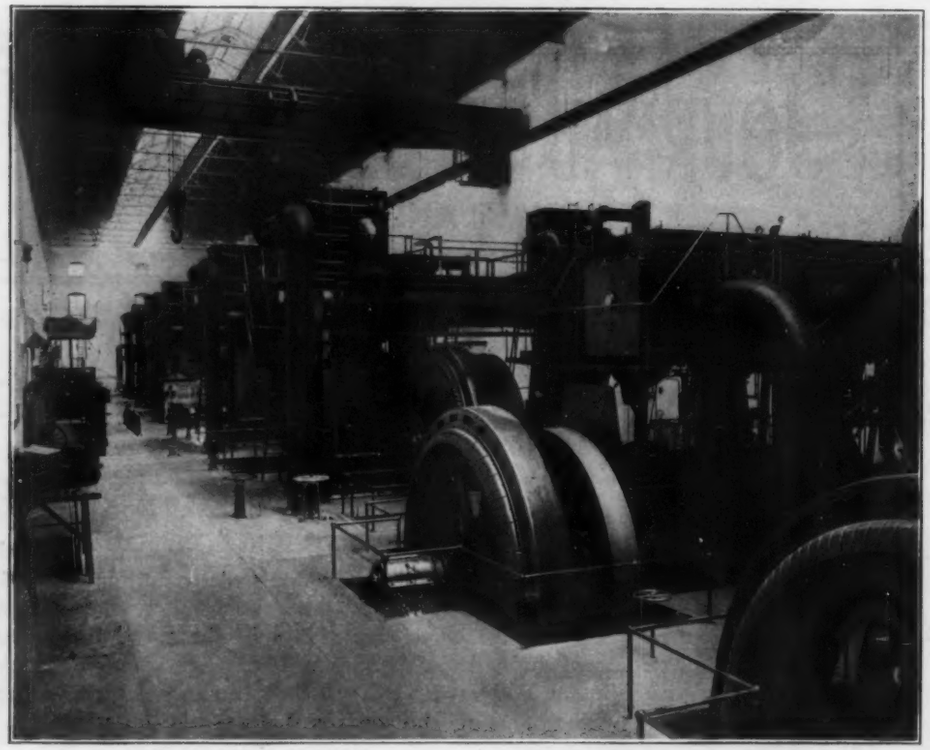


Turbine No. 6, Station "A."

In 1910 the first steam turbine installation was made. One of the 1500 kw. McIntosh & Seymour engines was removed and in its place was installed a 12,000 kw. vertical Curtis turbine. This is a five-stage machine and is provided with a base condenser with an auxiliary wing, having a total of 25,000 sq. ft. of cooling surface.

At the same time that this installation was made, 10 of the original Babcock & Wilcox boilers were equipped with Foster superheaters designed to superheat the steam 100 degrees. This is the only addition made in the boiler room as, owing to the much greater economy of the turbine, it was possible to shut down a number of the boilers and carry the same load with the turbine in operation, that had formerly been carried by the engines with all of the boilers in service.

In 1912 another of the McIntosh & Seymour engines was removed and in its place a 15,000 kw. tur-



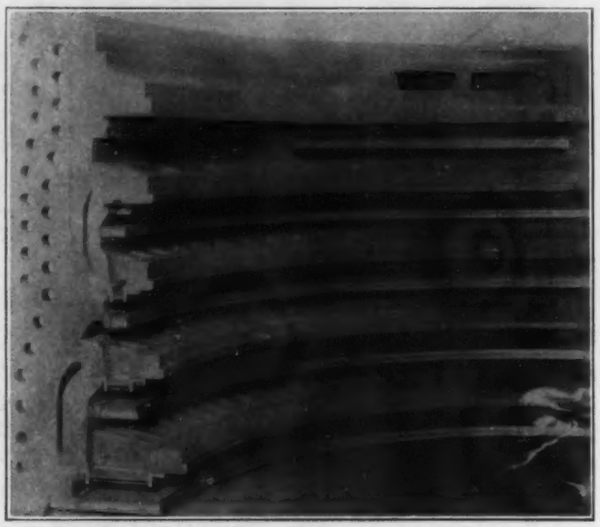
Interior Station "A" Prior to the Installation of Turbines.

bine was installed, this machine having 10 times the capacity of the engine which it replaced, although occupying no more space. This machine is similar to the first turbine installed except that it has six stages instead of five and its base is large enough to contain all the cooling surface required for the condenser.

There is now being installed a third turbine of 15,000 kw. capacity which is being placed in the space formerly occupied by the two 1500 kw. triple expansion engines. This machine is also of the Curtis vertical type, is designed for 175 lb. pressure, 100 degrees superheat and 28½ in. vacuum and provided with seven stages. Each of the first six stages has two wheels, each wheel containing 672 buckets, making 1344 buckets per stage. The seventh stage has only one wheel containing 560 buckets. The turbine contains, therefore, 8624 movable buckets. The buckets in the stages increase in length as the steam expands. In the first three stages the length of the buckets runs from 1 in. to 1¾ in. while in the last stage the buckets are almost 20 in. long. There is a free area of approximately 36 sq. ft. between the buckets in the last stage.

The condenser for this machine contains 29,000 sq. ft. of cooling surface made up of 1 in. tubes 18 ft. 2⅝ in. long, the entire condenser being installed in the turbine base. The condenser is divided horizontally into two passes for circulating water so that the water flows through the lower half of the tubes, then up and back through the upper half of the tubes. A portion of the cooling surface is separated from the circulating water so as to form a Voltz heater. The condensing steam is forced through the tubes of the Voltz heater after being withdrawn from the condenser. By this means the temperature of the condensate is kept within a few degrees of the temperature due to the vacuum.

The machine is provided with a complete set of auxiliaries, the principal ones being a dry vacuum pump having a 16 in. steam cylinder, a 42 in. air cylinder, with a common stroke of 24 in.; the two wet

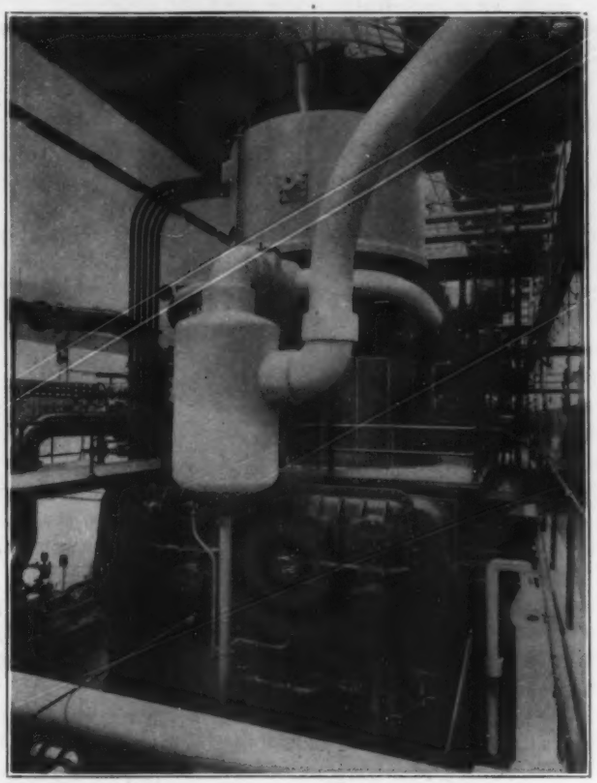


Segment of 12,000 kw. Turbine Showing Intermediate Buckets and Nozzles.

vacuum pumps having 8 in. suction and 6 in. discharge. These are two-stage centrifugal pumps, one of which is driven by a 30 h.p. Terry turbine and the other by a 30 h.p. General Electric motor. The oil for the step bearings is handled by two Dean horizontal duplex pumps operating at a pressure of 1200 lb. per sq. in. There is a 10x6x10 Worthington pump for pumping the oil to the guide bearings. The step

bearing and guide bearing pumps are connected to the corresponding systems of the other two turbines.

When this machine is in operation it will be possible to carry a load of 42,000 kw. on the three turbines with the same equipment of boilers as was provided for the reciprocating engines. This is just double the capacity it was possible to obtain from the station when using these same boilers when operating reciprocating engines.



Turbine No. 5, Station "A."

Circulating water is obtained from the bay, all the circulating pumps being located in a separate pump house located about 1000 ft. from the station. The water for the turbines is pumped through a 60 in. cast iron pipe which was installed at the time of the first turbine installation.

Quartz tube vapor lamps, like many other inventions, are being put to a variety of uses different to that for which they were originally intended. The excessive ultra-violet rays emitted, which first proved a detriment to the lamp, now finds application for it in new fields.

In Europe, carpet manufacturers who previously were put to considerable expense in shipping samples of their manufactured product to sunny southern countries, so that proper tests of the sun-resisting qualities of the colored fabrics could be made, now use the quartz lamp for that purpose. It is stated that at Rouen sterilization of water is effected, by the use of the quartz lamp, at the rate of 100,000 gals. per day. The capacity of the lamp used is only 750 watts. Much larger plants are also in successful operation.

Sterilization of water in the home in this way is a possibility, and may soon become a new and profitable central station load.

ELECTRICITY AND THE FIRE HAZARD.

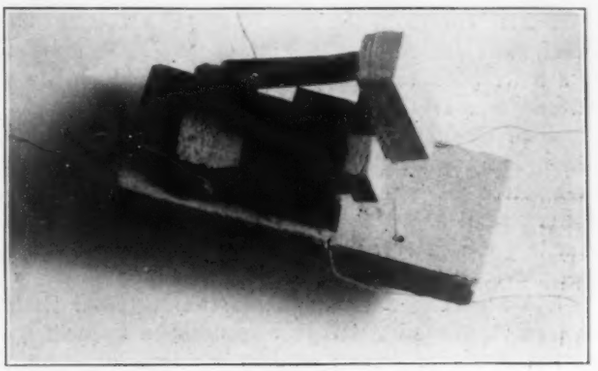
BY J. H. MONTGOMERY.

(Treating his subject in an interesting historical manner, the author first describes the birth and growth of the National Electrical Code; refers to the great hazard of early equipment as compared with that now used, and mentions also where electricity aids in reducing the fire hazard. The paper was originally presented before the Los Angeles Section, A. I. E. E., by the author. Mr. Montgomery is Associate Professor of Electrical Engineering at the University of Southern California.—The Editors.)

While Faraday's discovery of the induction of electric currents dates back more than eighty years and Gramme and Siemens built practical generators over half a century ago, the commercial use of electricity is a matter of comparatively recent date.

The Pearl Street Station in New York City is said to have been the first central station for the production and distribution of current for public use. It was put into service in 1882. The first general introduction of electric lighting took place however in the preceding year when a number of installations were made in the textile mills of New England.

One of the unexpected consequences of this use of current was a new fire hazard. The Manufacturers' Mutual Insurance Companies had insurance on sixty-

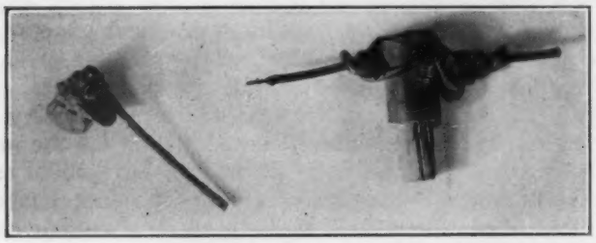


Home-Made Knife Switch.

five of these textile mills in which electric lights had been installed and during the first six months twenty-three fires from electrical causes took place in these properties. Following these and other similar experiences elsewhere the need of rules governing the installation of electric apparatus became evident. Mr. J. C. H. Woodbury, the engineer of the Mutual Insurance Companies, drew up what was probably the first set of such rules. These rules were compiled after consultation with Dr. Chas. F. Brush, Prof. Elihu Thompson, Mr. Edison, Mr. Weston and others.

From time to time other rules were formulated by various insurance organizations, manufacturing companies, municipalities and other bodies. Most of these were sincere attempts to secure safe construction. A few however were framed in the interest of certain articles so as to eliminate competition. These local rules varied greatly in their requirements so that what was demanded in one place was prohibited somewhere else and great confusion resulted. This condition was the subject of careful consideration at a meeting of the National Electric Light Association held in Cleveland in 1895. A committee was appointed at that meeting to consider the matter of rules. It soon became apparent that it was a thing beyond the scope of any one organization and accord-

ingly arrangements were made for a conference on rules which was held in New York City on March 18, 1896. All interested persons were invited. The various national bodies, insurance interests, manufacturers, inspectors and contractors were represented. Several days were spent in the conference. A large book was prepared with the various American, English, German and French rules pasted in parallel columns so that comparison could be made. The conference finally



Insulator Made of Wood Plug and Piece of Garden Hose. Part of Lag Screw and Guy Wire Burned Off by 110 Volts When Grounded to Tin Roof.

appointed a committee with Prof. Francis B. Crocker of Columbia College as chairman. After an immense amount of work extending over several months the committee compiled the first National Electrical Code which was issued in the Fall of 1897. It consisted of a little book of 52 pages and was endorsed by the various interests represented in the conference.

The Code Conference continued its work of revision and addition in co-operation with the Electrical Committee of The National Board of Fire Underwriters until a few years ago when it was all turned over to the Electrical Committee of the National Fire Protection Association.

As a sort of supplement to the National Code a List of Approved Fittings is published twice a year by the National Board of Fire Underwriters on the recommendation of the Underwriters' Laboratories.

The Laboratories were established in 1894 by the National Board for the purpose of making tests relating to the fire hazard. They have seven departments, viz: Protection, Structural Material, Gases and Oils, Chemical, Hydraulic, Signaling Apparatus, Electrical.

In the electrical tests the intention is to reproduce the worst possible operating conditions. Sockets are turned off and on by an automatic device until they either fail or pass the required number of operations, which is very high. Fuses are tested by being blown when surrounded by cotton. Rubber covered wire is subjected to insulation and breakdown tests. These tests are very thorough and are made by competent technical men.

The work is carried still further by means of factory inspection with frequent tests of the product. Labels are supplied to manufacturers whose goods are thus inspected in the factory and the presence of these labels means that the goods are up to requirements. A place in the List of Approved Fittings means that the manufacturer can make satisfactory material, the use of the label, that he is doing so.

Through the Code and the List of Fittings then we have a standard of material and installation. Why are all these elaborate precautions necessary? Because electricity has come to be a serious factor in the fire hazard. An examination of reports as to the causes of fires will show from one to eight or ten per cent attributed to electricity. To these must be added a certain proportion of the "cause unknown" fires. Even after making due allowance for the propensity of reporters and fire marshals to lay anything which they do not understand to "defective wiring" it will be evident that probably two or three per cent of all fires are due in some way to electricity. Investigation also shows that fully 75 per cent of these fires are from avoidable causes.

We may class these electrical hazards as Inherent and Avoidable.

Avoidable hazards may come from several causes such as poorly designed fittings, improper materials, wrong use of apparatus or poor workmanship. The history of the fuse block illustrates very well all of these points. At first a cutout was simply a piece of lead wire held under two screws on a wooden block. Then some genius put a bit of mica under the fuse. Here the material was wrong, since wood is inflammable and the design was bad in providing too small a separation of polarities and too small a break. The old "bug" and "horseshoe" canopy cutouts were examples of the same faulty design. Then came the "Sawyer-Mann" and "Edison" blocks of the link fuse type. The latter was very satisfactory in point of design but shared the objection of using porcelain. Porcelain is too fragile to withstand the blowing of heavy fuses; furthermore after continued use metal is deposited upon it until finally it will "arc over" and fail. The present types of enclosed fuses overcome most of the dangers of the older forms.

Unlined sockets and switches with too small current carrying parts are examples of poor design.

The cases of wrong use of materials and apparatus which come to the inspector's notice are numerous. Perhaps the most common are the use of undersized conductors and the overloading of switches.

Board From a Packing Box Set on Fire by a Lighted Incandescent Lamp Resting Upon It.

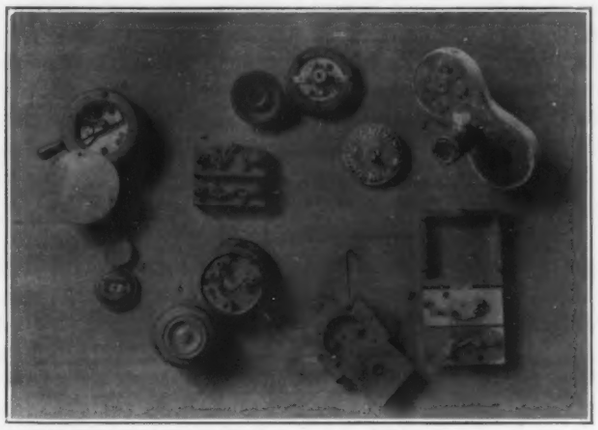
Poor workmanship is easy to find but hard to define. It is shown in defective joints, hazardous location of fuses and other apparatus and in poor wiring. The remedy for all these avoidable hazards is good material properly installed.

Inherent hazards are those which are inseparable from the normal operation of the apparatus. Such hazards are found in incandescent and arc lamps, rheostats, fuses, switches, etc. Of the total energy supplied to the ordinary carbon lamp only about 3 per

cent appears as light, the rest being in the form of heat. Examples of this sort of hazard are found in the installation of direct current motors in flour mills, woodworkers' shops and other locations exposed to dust. Rheostats and starters in similar locations are hazardous.

The hazard of fuses has been largely reduced by the use of the enclosed types. The gradual development of the fuse and fuse block from the original hazardous form has already been mentioned.

In this connection probably the most difficult thing to safeguard is the installation of the various forms of heating devices. A large proportion of real



Old Wooden Fittings. 1. Arc Switch. 2. Ceiling Rosette. 3. "Combination" Fixture. 4. Cut-out Fused with No. 14 Copper. 5. Small Cut-out. 6. Snap Switch. 7. Ceiling Switch. 8. Fuse Block.

electrical fires are from flat irons, chafing dishes and such utensils. It is an especially difficult matter to control since in most cases the device is portable and its location is left to the user who often has little idea of the possible dangers.

These inherent hazards must be taken care of in the design of fittings by providing for the dissipation of the heat necessarily produced by protecting the heated parts from possible contact with adjacent inflammable material.

Under this class of inherent hazards belong also those which are purely accidental such as the effects of lightning or stray high tension currents entering buildings over lighting circuits. The reversal of polarity in direct current work, transformer breakdowns and the mechanical disturbance of wires all come under this head.

One other source of trouble which should be noted, although its discussion is beyond the scope of this paper, is the effect of electrolysis. Water pipes which have been corroded are likely to break down, thus crippling the supply of water for fire protection. Again cases are known where explosions and fires have resulted from corroded gas mains. In this connection also it is of interest to note the serious deterioration of steel used for re-enforcing concrete when subject to electrolytic action.

Another hazard usually classed as electrical and covered by the code is the moving picture machine. The real danger point here is in the highly inflammable film. The early types of machine with their open reels were very hazardous. Improved construction has reduced the danger materially.

Another important connection between electricity and the fire hazard is in the various forms of signalling systems. Municipal fire alarm systems, watchman's time recording clocks, auxiliary fire alarms, thermostats, sprinkler supervisory systems, etc., are made possible only by the use of electric circuits.

In conclusion just a few words about the National Electrical Code. These rules are based on experience rather than theory. Sometimes they may seem to be contradictory, as when it is insisted that wires must be carefully insulated from the wood of a building and are then permitted to be run in wooden moulding which is nailed to the same wooden building. The best answer to such objections is that the various requirements have proved to be satisfactory and necessary. Certain requirements may not have come within the observation of one man and he therefore does not see the need of them. It should be remembered that these rules are based on the experience of many persons in various parts of the country.

Mr. Woodbury in an address before the National Contractors' Association at Cleveland thus characterized the code:

"The National Electrical Code I believe to be a most remarkable concentration of scientific practice and the property and business interests which it represents are immense. It is, of course, well known that the rules have an anomalous standing; they are not law; they have no legal status; they have no fixed, defined force of authority to compel compliance or legal penalties for infraction, and yet, appealing to public sentiment and to the pertinent interests by the force of their own inherent virtue, they are strong and potent in their application to the design, installation and operation of electric plants."

A Letter to the President sent by the American Institute of Consulting Engineers directs attention to the importance of the appointment of some able and experienced engineer to fill one of the vacancies on the Interstate Commerce Commission, and the reasons for such an appointment. The Insterstate Railway Commission is charged not only with the regulation of transportation rates, but also with the regulation and inspection of safety appliances used in our railways, with the investigation of accidents and with the stupendous and expensive task of making a physical valuation of the railways of the country; consequently many of the duties of the commission are highly technical. It is argued that the leading part taken by the engineer in the construction and operation of railroads peculiarly adapt him without special training to be of invaluable service to the commission whether in connection with the regulation of rates, the investigation of accidents and the determination of proper safety devices, or the physical valuation of railways. Touching upon the tremendous value of the work of the commission to the community the Institute respectfully suggests that the Interstate Commerce Commission should, for the reasons stated and others, include in its membership one or more engineers. The Institute emphasizes its position. It has no candidate to offer and no motive except to serve the administration.

PUBLIC UTILITY ACCOUNTING IN OREGON.

Instructions Pertaining to Uniform System of Accounts for Electric, Gas, and Water Utilities.

(Continued.)

5. **Discount, Expenses and Premium on Funded Debt.**—Ledger accounts should be provided to cover the discounts, expenses, and premiums on each class of funded debt issued or assumed by the company. By "Discount" is meant the excess of par value of funded debt securities issued or assumed, and the accrued interests thereon, over the actual cash value of the consideration received for such security (except securities that have been sold and re-acquired). By "Premium" is meant the excess of the actual cash value of the consideration received for funded debt securities issued or assumed over the par value of such securities and the accrued interests thereon (except securities that have been sold and re-acquired). By "Expense" is meant all expenses in connection with the issue and sale of evidences of debt, such as fees for drafting and recording mortgages and trust deeds, cost of engraving and printing bonds, certificates of indebtedness, and other commercial paper having a life of more than one year; fees paid trustees provided for in mortgages and trust deeds; fees and commissions paid underwriters and brokers for marketing such evidences of debt, and other like expenses.

If the net balance in any of these accounts is a debit, there should be charged to account "Amortization of Debt Discount and Expense," during each fiscal period (and credited to the discount and premium accounts in which the discount and expense is carried), such proportion of the discount and expense on the outstanding funded debt obligations, as may be applicable to that period. This proportion should be determined according to a rule, the uniform application of which throughout the interval between the date of sale and the date of maturity will extinguish the discount and expense on the funded debt. The charge to income for any period should not exceed the proportion applicable to that period, and a charge should be made for each period so long as any portion of the discount and expense remains unextinguished. In order that the discount and expense may be extinguished sooner, the utility may, at its option, charge to Corporate Surplus or Deficit Account all or any portion of the discount and expense on funded debt, remaining at any time unextinguished.

If the net balance in any of these accounts is a credit, there should be credited to account "Release of Premium on Debt" during each fiscal period (and debited to the discount and Premium Account, in which the premium is carried) such proportion of the premium on outstanding funded debt obligation as may be applicable to that period.

These proportions should be determined according to a rule, the uniform application of which throughout the interval between the date of sale and the date of maturity of the debt will extinguish the premium at which such debt was sold.

If the net of the balances in the "discount and premium" accounts for all classes of funded debt sold or exchanged is a debit balance, the amount should be included in account "Unamortized Debt Discount and Expense"; if a credit balance, the amount should be included in account "Unextinguished Premium on Debt."

Except as provided in section 12, (Interest accruing during construction period), no discount and expense on funded debt should be charged to or included in any account as a part of the cost of acquiring any property, tangible or intangible or as a part of the cost of operation.

6. **Contingent Assets and Liabilities.**—Contingent assets and liabilities should not be included in the body of the balance sheet statement, but should be shown in detail in a supplementary statement accompanying the balance sheet. Contingent assets represent possible sources of value contingent upon the fulfillment of conditions regarded as uncertain. Contingent Liabilities include items which may, under certain conditions, become obligations of the utility but are neither direct nor assumed obligations on the date of the balance sheet.

7. **Income Account Defined.**—The income account brings together those accounts that show the total amount of money that the utility has received, or become entitled to receive for services rendered during a given period, the return accruing during the period upon investments and disbursements and obligations (fixed charges) incurred that affect the disposition of the amount so received or accrued.

The sum total of the credit balances in the operating revenue accounts at the close of a fiscal period, diminished by the operating expenses, the taxes and the uncollectible bills assignable to such operations, gives the operating income (or loss) for the period.

To the operating income (or loss) are added the non-operating revenues less the non-operating revenue deductions, which gives the gross income for the period.

From the gross income are deducted various compulsory deductions; this gives the net income (or loss) for the particular period. From the net income are deducted such appropriations as are made from income; this gives the amount that should be carried to the "Corporate Surplus or Deficit Account."

8. **Taxes.**—Separate accounts should be kept of the taxes applicable to operating and to non-operating revenues, and if the utility is engaged in more than one utility service or other business, taxes applicable to such other utility service or business should also be kept separate.

The tax accounts should be charged at the close of each month and account "Taxes Accrued" concurrently credited with a month's proportion of taxes applicable to the operation covered by each account. If the exact amounts of the annual taxes are not known, they should be estimated, and one-twelfth of the estimated amounts charged each month. From time to time during the year, as the actual tax levies become known, the monthly charges should be adjusted so as to include as nearly as may be possible the total amount of the taxes in the year to which they apply. When any such tax bill is paid account "Taxes Accrued" should be debited with the amount of the payment. If the balance in account "Taxes Accrued" is a debit balance due to the prepayment

of taxes applicable to a period subsequent to that for which the income statement is given, the amount of the debit balance should be shown in account "Prepaid Taxes"; and if the balance is a credit balance, the amount should be shown in account "Taxes Accrued."

Taxes on property leased should be charged to the appropriate tax account by the party which under the terms of the lease contract is obligated for such taxes. If the other party to the lease, as a matter of convenience, pays the taxes to the public authorities, such taxes should not enter into tax account.

The tax account must not include any fees or charges sometimes called taxes, such as water taxes, drainage taxes, fire taxes, etc., which are payments for some specified service rendered by the government.

9. **Corporate Surplus or Deficit Account Defined.**—This account or summary is the connecting link between the "Income" Account and the balance sheet. It summarizes the changes in the corporate surplus or deficit, during a given fiscal period, resulting from the operations and the business transactions during that period, as well as those effected by any disposition of net profit made solely at the option of the utility, by accounting adjustments not properly attributable to the period, or by miscellaneous losses or gains not provided for elsewhere. The Corporate Surplus or Deficit should be shown on the balance sheet statement under account "Corporate Deficit" or under account "Corporate Surplus Unappropriated."

10. **Fixed Capital Defined.**—By the fixed capital of a public utility (frequently termed the "Construction Account") is meant the property, both tangible and intangible, which is devoted to the accomplishments of the principal purposes of its business, and which has an expectation of life in service of more than one year from date of installation in service (exception being made in the case of hand tools and other small portable tools, that may be lost or stolen).

Fixed capital may be described as consisting of original capital, additions, betterments, and replacements, as defined below.

Original capital is the fixed capital installed or acquired prior to the beginning of regular operation by the utility. It includes the acquisition or construction of the plant necessary to begin the regular operation of its business. The cost of original capital should be charged to the appropriate sub-accounts under "Fixed Capital Installed prior to July 1, 1913," or under account "Fixed Capital Installed since June 30, 1913."

Additions are structures, facilities, equipment, and other properties added to those in service at the beginning of operations, and not taking the place of any property of like purpose previously held by the utility. The cost of additions should be charged to the appropriate sub-accounts under account "Fixed Capital Installed since June 30, 1913."

Betterments are mechanical changes in structures, facilities, or equipment which have as their primary aim and result the making of the properties affected more useful or of greater capacity than they were at the time of their installation or acquisition. The cost of such portion only of the changes incident to betterments as will, when added to the original cost of the property bettered, give the cost of replacement or reconstruction in present condition of the property as bettered should be charged to the appropriate sub-accounts under "Fixed Capital Installed since June 30, 1913." The remainder of the cost of the change should be classed as "Extraordinary Repairs" and be charged to the appropriate operating expense accounts.

Replacements are those installations or fixed capital which have for their purpose the substitution of one building, structure, pieces of equipment, or machinery for another which it has become necessary to retire, the substitute having substantially no greater capacity than the property replaced; also the extension of life period of franchises, patents, and other intangible fixed capital.

The cost of the fixed capital retired should be credited to the fixed capital accounts in which it is carried and the cost of the fixed capital installed in place of fixed capital so retired should be charged to the appropriate sub-accounts under "Fixed Capital Installed since June 30, 1913."

11. **Cost to Be Actual Money Costs.**—All charges made to fixed capital or other property accounts with respect to any property acquired on or after July 1, 1913, should be the actual money cost of the property. When the consideration actually given for anything with respect to which a charge is made to any fixed capital or other property account is anything other than money, the actual consideration should be described in the entry with sufficient fullness and particularity to identify it, and the account charged should be actual money value of such consideration at the time of the transaction.

12. **Interest Accruing During Construction Period.**—"Interest During Construction" should include only such proportions of the interest on funds used for construction purposes and of the discount and expense on funded debt as is equitably assignable to the period between the date of the issuance of securities and the time when the property acquired or the improvement made through such issuance becomes available for the service for which it is intended. The proportion of interest discount, and expense thus chargeable should be that which the period prior to the completion or coming into service of the facilities or improvements constructed bears to the entire life of the securities issued.

13. **Costs of Labor, Material and Supplies.**—The term cost as used in the fixed capital (or construction) account means the actual cost in money of labor and materials used in construction, or the actual cost in money of property acquired after construction, or if the consideration given is other than money, the actual money value of such other consideration at the time of the purchase. Cost of labor includes not only wages, salaries, and fees paid employes, but also the personal expenses of such employes when borne by the utility. Cost of material and supplies consumed in construction is the cost at the place where they enter into construction including cost of transportation and inspection when specifically assignable. If such materials and supplies are passed through storehouses, their cost entered in the account may include a suitable proportion of store expense.

[To be continued.]

INTEGRATING METERS IN EFFICIENCY TESTS.

BY C. S. HULL.

(In this article the author describes a method of measuring the output of turbo-generators during efficiency tests by the use of carefully calibrated watthour meters. Such a method is practically essential, due to the varying load conditions which obtain and which make it almost impossible to determine the average readings of indicating instruments over a long period of test. Mr. Hull is connected with the standardizing laboratory of General Electric Company at San Francisco.—The Editors.)

It is the usual practice in making efficiency tests of large steam turbines to run at constant load for three of four hours in order to make sure that all the operating conditions have become settled.

It is customary to measure the output of the turbo-generators by carefully calibrated portable wattmeters used in connection with current and potential transformers. If the load conditions are reasonably steady, this method is probably the most accurate. In most instances, however, the tests are made with the machine on the line, in which case the load conditions are continually varying. It then becomes at times almost impossible to accurately read the average indications of the instruments for a long time.

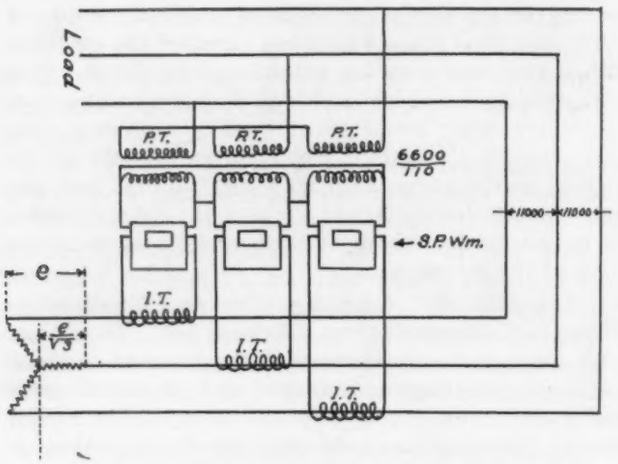


Diagram Showing Method of Using Three Meters and the Extra Transformers for Measuring the Output of Turbo-Generators in Efficiency Tests.

Realizing these conditions the General Electric Company has successfully used integrating watthour meters in several important tests. These meters are fitted with diamond jewels and dials which will record between three and four hundred times as fast as ordinarily, so that a good reading can be taken every ten or fifteen minutes. These meters are calibrated with their transformers and connected load as they will be used in the actual test, conditions being as nearly the same as it is possible to make them. In case it is impossible to check the meters with their transformers and no other transformers are available, the corrections for ratio and phase angle as furnished for the standard line of current and potential transformers are used. The corrections will always be found to be very close for transformers of like type. For more detailed information in regard to the method of determining these errors in transformers and applying necessary corrections, the reader is referred to a paper by Mr. L. T. Robinson, Proceedings A. I. E. E., June 30, 1909 Volume, which covers the subject in a most complete manner.

The question will naturally arise as to the proper number, type and scheme of connections of the meters to be used. In a straight 3-wire polyphase system either a polyphase or two single-phase meters will give correct results.

A polyphase meter has an advantage over two single-phase meters at low power factor. At 50 per cent power factor, assuming full volt-ampere load, a polyphase meter will run at one-half speed, whereas in the case of two single-phase meters, one of them will not run at all. Also below 50 per cent power factor, one of the single-phase meters will run backward. Here is a chance for a slight error due to the fact that the meters are compensated for friction for a forward rotation. These errors are all very small, but in accurate work must not be lost sight of.

The three meter method of measurement has several advantages. In the first place all will run at the same speed, regardless of power factor, each recording 1/3 of the output. In case of accident to one or even two of the meters, the other may be considered as having recorded 1/3 of the power. If the system is 4-wire, 3 phase, three meters are essential for accurate readings. The three-meter method of test requires (except when the station is already so wired), three extra potential transformers having a primary rating equal to 57.7 per cent of the line voltage. For tests on 11,000-volt systems, 6600-volt potential transformers are used. If a polyphase meter or two single-phase meters are used, the transformers in the station are generally available either by previously checking them or by taking their characteristic curves.

In considering the degree of accuracy which may be expected in a testing outfit made up of integrating meters, a variety of conditions must be considered. We correct for the controllable conditions. The uncontrollable include variations in temperature, power factor, and wave form due to load conditions. It is therefore safe to say that with the meters carefully standardized, an accuracy within one per centum may be expected, although often in practice much closer results are obtained. We have had on several occaions tests in which two single-phase, three single-phase and a polyphase meter were connected in the same circuit and checked each other within one-half per cent maximum variation on runs of four hours or more duration.

In the diagram is shown the method using the three meters and the extra transformers.

Natural gas consumption in the United States in 1912 was 562 billion cu. ft., at an average price of 15.04 cents per 1000. On the assumption that 28,000 cu. ft. of gas equals in heating power 1 ton of coal the fuel displaced last year was equivalent to 20 million tons of coal.

Through rates to all points on freight and passenger traffic will result from arrangements now being completed by the Pacific Electric Railway Company, Los Angeles. The local rate will be absorbed by the connecting road. The electric line thus becomes a feeder to the three transcontinental lines operating out of Southern California.

THE QUESTION OF ENGINEERING EDUCATION.

The following discussion of their views on the question of engineering education was recently submitted by the Oregon Society of Engineers to the president and members of the Board of Higher Curricula, State of Oregon:

The discussion is, as closely as possible, confined to the points brought up in your letter to the society, viz.: (A) Defining the terms "Professional Engineer" and "Industrial Engineer"; (B) Outlining courses for each that would give the minimum requirements to produce competent and safe engineers, yet not shut out the boy of limited means; (C) Showing how far the two courses would be similar and where they would differentiate.

The first question is well answered by quoting from the paper of William McClellan on "A Suggestion for the Engineering Profession," Proceedings of American Institute of Electrical Engineers, June, 1913, as follows

The engineer of today traces his ancestry along two distinct lines, one practical, the other theoretical. In times past what we call engineering was done either by a skilled mechanic or by a scientist having a practical bent. As the demand became more and more complex, and as science opened up wider and wider fields of knowledge, the mechanic became more and more skilled in certain ways, and some scientists became more and more practical. The merging of these formed a group of workers, having common aims and now known as engineers.

The skilled mechanic, however, from the standpoint of quantity, was by far the larger element. One need go back only to pioneer colonial days to learn that practically all of the engineering, as we know it, was done by the surveyor, the millwright, the master carpenter, the master mason, the smith and others. Even now many a smith claims to be able to forge without plans a hook equal to any that a mechanical engineer can design, and many a country carpenter will frame quite complex roofs of a variety of types, all "out of his head."

Passing quickly over many interesting details, we find that more or less on account of their industrial lineage engineers are divided into classes. Once there were two of these, civil and military. Later, starting with the multiplication of engines and machines, the civil class divided up into the almost innumerable varieties of engineers, which it is unnecessary to list here—if we could.

As a result, while there are many men of a great breadth of mind and experience worthy of the title of "engineer," there is no one who can claim it in the same way that lawyers and doctors can claim their titles. There are engineering professions, but there is no one profession. There are engineering degrees, but there is no one engineering degree. There is no engineer without an adjective. It must be acknowledged that there is some truth in the charge of "lack of breadth," considering the whole body of engineers. It is also curious that in medicine and law the students leave school with all the same general training and degree, but specialize afterwards, whereas in engineering they are specialists at school. So far as individual activity is concerned, engineers are of different types in same way that lawyers and doctors are, but to a greater degree of demarcation. Today all the numerous classes of engineers contain three distinct types of members:

First, the theoretical engineer, who in reality is not an engineer. He is, and it would be proper to call him, an applied scientist. Many of the engineers in our great electrical manufacturing companies are in this class.

Second, the mere manual and mental operative, the hewer of wood and drawer of water in the engineering world.

Third, the real engineer, who can design and create, who can adapt the resources of nature efficiently to the service of man.

In passing, it may be remarked that the presence of these three types in each class of engineers is the chief difficulty in arranging proper courses in engineering education.

Many will remember how often within the last few years a demonstration or recommendations by a united engineering profession would have been valuable. Society needs such help in connection with conservative discussion, appointments of the many municipal, state and national commissions involving engineering in some form, opposition to ill-advised or vicious laws, methods of conducting public work, and a variety of other similar matters. When unity is so desirable or even necessary, a great effort is worth while to obtain it, but the question is, how?

We might turn to the colleges or technical schools. I have suggested before, and long to see the time, that some prominent school shall offer the degree of Bachelor of Engineering, and give all such students the same general course with a very small percentage of special electives. The schools are moving in this direction, and we should have great faith in them. Of necessity the progress is slow, and will not answer immediate needs. If revolutionary changes were possible at once, the effect would not be seriously felt for years. The schoolmen must be given time to work out their plans. Outside engineers may occasionally offer valuable suggestions, but they are much less able to attack the problem than those whose business is to study it at close range.

By way of summary we will say that the professional engineer is one who is qualified by breadth of scientific and technical training, experience, executive ability and knowledge of economic questions, to conceive, design and carry into execution safely and economically, entire engineering projects; also by application of general scientific principles and knowledge gained by experience, to meet and solve unforeseen and unprecedented engineering problems and thus truly become a factor in the progress of civilization, in other words the third class of man referred to by Mr. McClellan in the above quotation.

The term "Industrial Engineer" as used by some of our members in oral discussion at your meeting of August 25th was meant to cover the second division referred to by Mr. McClellan. This term has not heretofore to our knowledge been used and in our opinion was not well chosen as the class of men which it was intended to describe should not properly be called engineers. They are properly in the class of skilled artisans, draftsmen, surveyors and others whose work requires considerable technical knowledge but is not of a truly professional character.

The term "engineer" is one very loosely used and applied to men requiring for their work a great difference in qualifications from that of the locomotive engineer, the steam shovel engineer and many other positions which do not rank higher than that of a mechanic, to the position of the truly professional engineer, where the highest degree of scientific and practical knowledge and ability is required.

It is questionable whether or not the term "engineer" should be applied to those having such a vast

range of qualifications. The question as to whether it would be best to classify the great mass of subordinate engineers by some other name or to designate in some new manner the small minority of engineers who have truly professional qualifications is one which must eventually come up for consideration if engineering is to reach the truly professional plane to which it is entitled, but is a question which we will not attempt to discuss at this time. Suffice it to say that relatively few engineers are required by their work to act in a truly professional capacity, whereas the majority occupy subordinate positions where a high degree of technical knowledge along some special line is required but where their value is chiefly represented by the amount of work accomplished and it was the latter class which was intended to have been defined by the term "Industrial Engineer."

The doctor performs the operation while the trained nurse attends. The nurse may be fully competent to perform many operations but his or her training has not been such that we are willing to impose this confidence in the nurse. Just so the professional engineer occupies a place to compare with the doctor and there has grown up a distinct class of engineers to compare with the trained nurse.

Outlining Courses.—In considering this matter it becomes necessary for us to discuss the four alternatives which are now being considered by your Board, viz:

1. Proceed practically as at present with some slight revision with a short course at the Agricultural College and a long course at the State University.
2. Parallel all courses in each of the two institutions.
3. Consolidate all engineering at the State University.
4. Consolidate all engineering at the Agricultural College, on account of mechanical equipment located there.

As throwing some light on the policy to be followed with reference to the above alternatives, it should be said that the practical training of the professional engineer should partake more of the nature of laboratory work in becoming thoroughly grounded in physical principles than that of actual shop practice, which is admirably suited to fit a man for the subordinate engineering positions. The professional mechanical engineer for example, should know what operations can be performed by modern shop equipment such as lathes, planers, etc., and to what accuracy this work can be done. He should also know the behavior of the various metals under conditions of use, but he need not necessarily become proficient in the actual operation of the machine lathe or any other shop equipment. It is true that such information is of some value to him, but the entire field of knowledge in mechanical engineering is too great for him to attempt to master it. He will devote his time to the determination of larger, more important and fundamental problems in the design of machinery and leave to the skilled draftsman the working out of mechanical details which require an intimate knowledge and experience in machine shop practice.

We have given the question of the four alternatives very careful consideration and have received from some of our members very valuable papers which we attach for your record. Out of our investigation we must strongly recommend that the first alternative of proceeding nearly as at present with a short course at Corvallis and a long course at Eugene be continued, with some slight modifications to be submitted in a subsequent paragraph. In our opinion, the excellent and large shop equipment at Corvallis is admirably suited to the training of the subordinate or, if you please, "Industrial" class of engineers. We do not believe there is now, or ever will be, a demand for two professional engineering schools in the same state and so closely adjacent to one another, educating men for the minority positions, whereas there will continue to be an increasing demand in this state for a technical school which will train a large number of students in an immediately practical way for subordinate posisitions in all branches of the engineering field.

It is also our opinion that the training of professional engineers should remain at the State University where shop work is sacrificed to some extent in favor of laboratory work and where the various co-ordinate studies are better suited to train the student in the broad way required for the professional field. What has been said of the professional engineer also applies to the professional architect.

Long Course.—We are training in this course professional engineers, at least men who may ultimately qualify, although a long period of their lives may be spent in work alongside of men trained in the short course. However, the experience in practical work is essential to develop a good engineer and on the basis of a proper fundamental training the long course man will ordinarily outstrip the short course man, and be properly qualified to take the lead in professional work.

That human factor ever present, that would in occasional cases make the trained nurse a better doctor than the professionally trained man whom he is assisting, will apply to engineering as well, but since we are not dealing with particular cases we must plan for the masses and assume that the particular cases will take care of themselves.

We have examined the courses of the best schools in the country including Cornell, Michigan University, Massachusetts Institute of Technology and University of Wisconsin. We find that there is no important difference in the work of each. These courses are the work of men like Dean Turneaure of Wisconsin and President McLaurin of Massachusetts Institute of Technology and many of whom have had a number of years of actual experience in engineering work before coming into the colleges.

General principles should be taught. Details may be learned in actual work after graduation. Psychology should be introduced early in the course. Logic, public speaking and debate should be a part of the professional engineer's training; also economics, political economy, money and banking, sociology, ethics, commercial law and business practice.

The professional engineer is usually the employer of other engineers in lesser capacities for handling the details, such as gathering and classifying data, making surveys, supervising construction and detail design. As a matter of fact, the man on detail design

may have more knowledge of his subject than the engineer whose specifications he is following. There should not be much specialization in the training for professional engineers. This can better be worked out after the man has found his life employment. One good point in having the professional engineer trained at the State University is the broadening influence of his associations with students of other professions and aims.

It is believed to be the experience of the technical schools that the strictly technical training required to fit a student for a truly professional capacity requires four full years of college work leaving no time for such subjects as economics, psychology, etc., mentioned above. Many technical schools are therefore advocating that their students take five years for graduation and incorporate in their course a considerable number of these broadening studies which are required for the professional engineer. With this in mind we would strongly recommend that the professional course at Eugene be made a five years course and would advocate that the professional degree of civil engineer, electrical engineer, etc., be not given even then at graduation, but only after a student can show evidence of one to three years practical experience in the engineering field after graduation and the presentation of a thesis based upon some practical work in which he has been engaged. Four years of high school work should be required for admission. At the end of four years of college work the Bachelor degree could be given.

Our recommendation as to the thoroughness of work to be taught presupposes a more liberal allotment of money for this purpose than has been available in the past.

Short Course.—We are training in this course specialists in some particular branch of engineering, men qualified to take up the routine work of surveyor, draftsman, estimator, superintendent of construction, structural designer, etc.

In fairness to this class of students the college entrance requirements should be two years and two years only of high school. At the end of four additional years these men should be graduated with a certificate of merit stating the particular work for which they are qualified, and not a bachelor degree as now given at Oregon Agricultural College.

It might seem that since the short course is designed to aid the poor boy to get into profitable work quickly, that we are restricting his chances by making him specialize, whereas the five-year student has a general education that would give him a wider field in the selection of employment after graduation. However, there is the element of chance to consider, since the professionally educated engineer has greater competition for his coveted place in the world and perhaps nine out of ten will have to content themselves with a position along side of the short course man, specializing on detail work. The positions requiring special work are far more numerous than positions filled by professional engineers; hence the short course man has a better opportunity of obtaining immediately profitable work than the long course man.

We do not believe that the professional engineering course should be based upon the minimum in the interest of the poor boy. We believe that the boy who has the native ability and energy to make a successful professional engineer even with a vast amount of training, will have the ability and energy to earn his expenses through his engineering course if necessary. Many of our best students in the engineering schools as well as in other schools, earn their entire expenses and are better citizens and better fitted for taking responsible positions for having done so.

We have not worked out the exact studies and the number of hours to be spent on each for either the long or short course, as this involves a vast amount of study and a detailed knowledge of how much work can be covered by a student in a given number of weeks, with which only the engineer in actual teaching work is familiar. This had best be left to the instructors in the University or Agricultural College or might be submitted to a committee of technical educators of wide experience such as Dean F. E. Turneaure, of the University of Wisconsin or President McLaurin of Massachusetts Institute of Technology.

We have, however, appended to this report some tentative courses of study worked out by individual members for your consideration.

Similarity and Divergence of Courses.—Since we have recommended the continuation of the long course at Eugene and the short course at Corvallis, the question as to how long these two classes of students could study together and when they should differentiate, is no longer pertinent. It should be said however, that even though these two courses were in the same school, a difference in preparatory training and in the thoroughness with which the subject should be mastered would make it difficult to conduct them in common except in the case of fundamental sciences such as mathematics.

Duplication in the Two Schools: We feel it necessary to make a few remarks upon the effects of our recommendation upon the duplication of apparatus, equipment and teaching force in the two institutions.

In this connection it must be remembered that for efficient classroom work the size of the class should be limited and the number of instructors to handle the classroom work would therefore be proportional to the number of students and no economy would be effected by combining the two courses in one school except perhaps in some saving in heads of departments. This saving however, would be to the disadvantage of the students as they would have less contact with the older and more experienced teachers.

As regards equipment it must be said that as nearly as we can learn, the equipment at both University and Agricultural College is nearly all in use continually and to the highest efficiency. In addition, as previously mentioned, the University training would tend to a minimum of actual shop practice in favor of an increase in laboratory work, thereby requiring somewhat the same general difference in equipment which now exists in the two institutions.

Respectfully submitted: W. S. Turner, L. F. Harza, W. H. Crawford, Henry Blood, H. L. Vorse, Special Committee, Oregon Society of Engineers.

Orrin E. Stanley, Secretary Oregon Society of Engineers.

LOAD-FACTOR BUILDING.

BY R. B. MATEER.

(The author who has specialized on the subject, gives an interesting resume of what is necessary for the building up of a good load-factor and its co-operative value as a business builder for all. This paper was presented by Mr. Mateer at a meeting of the San Francisco Electrical Development and Jovian League.—The Editors.)

Seeking a subject of mutual interest to dealer, contractor and public utility, it was suggested that perhaps an outline of the duties that have, for a number of years, characterized my share in the development of public utilities with reference to the methods productive of the best results and the value of such work to all engaged in the business growth of everything electrical might be of interest. Accordingly I tender a few remarks on load-factor building—scientific promotion of the sale of current with special reference to the filling up of the valleys of the load curve.

Not many years ago, every light and power company confined its attention to the marketing of current for illuminating purposes only. Then a few daring pioneers conceived the idea of a day circuit and the sale of a few motors to drive machinery in the shop. At a latter date electrical appliances were advocated. Each contibuted to the use of "juice" over longer periods of time and resulted in greater earnings to the utility with added profits to those interested in the sale and installation of current using appliances. Yet, up to a few years ago but little attention was given to the systematic development of those classes of business which would even up the load curve—the graphic illustration of the operating conditions of every utility. Salesmen are sent out to canvas in a more or less haphazard manner, the residence, shop or factory. Illumination generally occurring at periods of highest demand and resulting in a minimum of current used with a revenue of $1.00 per month per consumer is the result of such effort. Perhaps a motor of some 5 or 30 horsepower is signed up guaranteeing a monthly revenue of 5 or 30 dollars, according to the connected load, yet the actual current consumed may be only from 100 to 500 kilowatt hours per month and occurring at such times as either coincide with the lighting peak or aid to build up other peaks occurring in the morning or afternoon. But of what value is such a load that only assures a consumption of 3 or 4 per cent of the possible energy available for a period of twenty-four hours per day? You who are charged with the earning of dividends on the funds entrusted to your care by a confiding public may perhaps know what your load-curve looks like. Will it show only a small demand for current from midnight until 6 p. m. with occasional morning peaks as the machine shop motor is turned on; while from 6 p. m. the load rapidly increases until 8 o'clock when every available generating unit is turning out energy for the apparently insatiate needs of your customers. Yet within the hour the desire for service rapidly decreases and by ten o'clock it is only necessary to operate one of the several generating units while the greater portion of the investment lies idle. Or perhaps by reaching out for business, industrial load is secured and a good output in kilowatt-hours is assured from 8 a. m. until 10 p. m., after which it is necessary to operate only the smallest units to supply the intermittent, standby service.

Conditions above outlined are descriptive of many of the load-curves of the quasi public utilities throughout the country. Each is startling evidence of the need for a comprehensive study of the customer's requirements; of a failure to analyze the territory served, together with a lack of appreciation of scientific methods of commercializing electric service by advocating current using devices and at such times as will assure the operation at maximum load of 70 per cent or more, of the total generating machinery installed.

Load-factor building—the development of an operating curve showing a continued demand for service at or near the full rated capacity of the generating station and for a 24 hour day or a year of 8760 hours is not a dream but a reality when aggressive means are used to fill up the valleys of the daily load curve and incidentally when contentment with present results ceases to be a virtue.

Methods—Of all the schemes for building a good load-factor those most essential to success are: a knowledge of the territory supplied with service; a knowledge of the customer's needs; familiarity with the service requirements of modern electrical appliances; the development by solicitation, advertising and demonstration of confidence in appliances and their use by a consuming public; the upkeep of a broad and up-to-date system of records showing the location of every appliance on the system; the opportunity for additional educational effort and the marketing of other "juice" using apparatus; an aggressive organization consisting of active district agents alive to the opportunities for business and operating under the direction of an up-to-date commercial agent, not drafted from other fields of labor but trained along the lines of central station activities. And last but not least co-operation between dealer, contractor, consumer and utility. Passing over all discussion on the above methods, here given as a result of a number of years in the field, permit me to present a few of the "fifty-seven varieties," or rather, to be exact, four hundred and sixty actual uses for electric service that are employed to a limited degree or fail to receive the support of the central station and dealer in their pursuit for profits, illustrating also, how they may be so dovetailed that the utility will present a load curve without a valley and with only a barely perceptible peak.

The residence—For the residence, the general use of the electric range, in service daily four out of every 24 hours; the toaster, percolator or chafing dish in use one out of every twenty-four hours, the washing machine and mangle six hours each week and with the iron showing on the Monday and Tuesday charts a very noticeable increase in day load; the vacuum cleaner with eight hours' service each week all contribute to the use of current where most desired. Again for the hot weather the fan, and for chilly days the electric heater, generally a day load, but aiding in the evening hours to reduce the lighting peak by the use of current over a period of several hours' duration, are useful in load-factor building. The average residence curve would show a demand for current, varying according to seasons of from fifteen hun-

dred to twenty-five hundred watts from 6:30 to 7:30 a. m. with a demand of 500 watts continuing at least one day of the week until 11:30 a. m., then a demand of 1,000 watts until 12:30 with from 100 to 750 watts at least one day of the week until 4:30. From 4:30 until 6:30 p. m., 750 watts is required until illumination is needed; when from 300 to 500 watts for a few hours are recorded on the meter. Largely a day load and sought by lighting companies—if aggressive.

The shop—For shop and mercantile establishment little current is demanded except at or near closing hours, which is so largly responsible for the poor load-factor of such business. To broaden out the peak—display lighting sign or window illumination from dusk until midnight is sought, giving a load-curve showing little or no consumption until 6 p. m., then a peak of short duration, and a continued pull on the lines by reason of the use of decorative lighting and electrical advertising until midnight.

Industrial—For mill and factory, driving line shafts, operating long lines of machinery or for individual operation of a particular machine, motors are installed and result in a fair demand for service from usually 8 a. m. until 12 and from 1 until 5 p. m.

Peaks usually in the morning are characteristic of such loads, which still give us a noticeable valley in the curve. How to remedy a condition such as the three load curves super-imposed one on the other will show, is a problem ignored by many, considered by some and solved by a few.

Special attention is directed to equipping the home with and encouraging the use of every electrical appliance, small as well as large. Flat rate schedules or automatically controlled circuits coupled with aggressive development of long hour display lighting reduces perceptibly the night peak. Educational work in outlying districts develops a pumping load stretching over the morning hours from midnight and until 4 p. m. the succeeding afternoon. Dairy and creamery—electric milking, cream separating and refrigeration, demand current from midnight and until at least five in the morning. Vehicle charging requires service from 10 p. m. until 6 a. m. with a peak usually at 2 a. m. These and other applications of electric service, at periods when markets are most desired are the result of a study of the load curve, not merely the ambition to sell current indiscriminately. I might continue at some length, treating on the load-factor of a combined system and the value of developing a pumping and agricultural load in one district; an industrial in another; display features in all business centers and seashore resorts, that the curve of each district super-imposed on the other might show a uniformly even demand on the entire system of 70 per cent and better, but many ask where does the dealer and contractor come into the game of load-factor building?

No appliance can be marketed without the dealer reaping his profit. The aggregate profits must largely hinge upon the utility and its aggressiveness in developing a territory and its co-operating with the dealer in live appropriate displays; advertising and marketing by seasonable campaigns his current using apparatus. No dealer can rest on his oars and have utilities when progressive, drag him along. Where the public utility inaugurates a campaign, the dealer should supply the stock and bear his proportionate share of advertising, leaving to the utility the charges incident to management rental, illumination and appliance sales business creation, or missionary work.

A co-operative game is load-factor building, with much of the profit on appliances going to the dealer, the lighting and power corporation profiting on the increased market for current, resulting in a good load-factor and the tucking away of some "velvet."

For the contractor, load-factor building results inevitably in greatly increased business. Where ranges and heaters are installed heavier feeds are essential; all power driven apparatus, motors, compensators, relays, etc., must be wired; vehicle charging demands expert attention for batteries; new buildings in city and in country must be wired as to pass inspection; supplies must be delivered electrically. Each resulting in profit to the contractor.

It may be stated in closing that while it is up to the utility to supply the funds, load-factor building is successful only when co-operation is accorded the commercial agent in charge of such development, by the contractor, dealer and staff. When grasping the opportunity to develop a satisfactory load-factor it should be remembered that results are attained only by the use of an aggressive business campaign inaugurated and continued by live harmonious management. Time prevents my quoting data as to load-factor of various apparatus used in building up ideal operating conditions for utilities, yet I unhesitatingly state that under a policy as here briefly outlined, a load-factor is excess of fifty and frequently of seventy per cent is possible.

INTERNATIONAL ELECTRICAL CONGRESS.

The International Electrical Congress is to be held in San Francisco during the week beginning September 13, 1915. It is one of a group of meetings, as follows:

Week beginning September 6th, International Electrotechnical Commission.

September 13th, International Electrical Congress.

September 20th, International Engineering Congress.

September 27th, International Gas Congress.

October 4th, American Electric Railway Association.

The congress program has been divided by the executive committee into twelve sections. Arrangements have been made with the Panama-Pacific International Exposition Company for the reservation of a main auditorium and several meeting rooms in the auditorium (now building) at the civic center in San Francisco. Attemps to reserve rooms for delegates in hotels of San Francisco so far have not been successful, due to reluctance of hotel managements to commit themselves. Preliminary work of an informal nature has been done by Dr. Kennelly and Mr. Mailloux looking to the securing of notable papers for the congress. In addition, Dr. Kennelly is now engaged in issuing about 125 letters to distinguished electrical engineers asking their suggestions of topics which should be discussed before the congress and of authors who should be invited to contribute.

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EDITORIAL NOTE.

As last week's editorial on "Western Distributing Warehouses" is susceptible of misinterpretation, the management of this journal wishes to correct any wrong impression which may have been unintentionally created. Its publication was inadvertent, and its policy is not endorsed.

A Merry Christmas

Christmas and the bells—the one suggestive of the other. List! From out the past memories almost audible recall the clear notes of the bells as they rang out merrily across the crisp air. They were the same bells which we heard always, but on this day they seemed different as they conveyed to we little children and those of larger growth, their message of a Merry Christmas.

Inharmony is unknown to the true note of the bell. Cling! And out across the county's side it carries its cheering message. Clang! Out again in never ending circles of sound until it reaches the remote hovel with its message of happiness to the humble dwellers. Giving always giving and so symbolizing the season of gifts. Cling! Reluctantly almost it ceases, but it will vibrate always is memory to make us glad.

Surely at this season of peace on earth to all men of good will, the selfish and sordid ends sought may be silenced and the finer sentiments catch the sweetness of the sounds which the harmony of life holds stored for us.

Now if ever we may be willing to give in that unselfish spirit which calls for no reward but that which results from the pleasure of giving—which gives that others may obtain happiness.

So the Journal sends out to its readers in a spirit of good-will this sincere wish for you happiness at this season, just as it would eddy out from the bell, and with the hope that it will find echo always in a myriad hearts that are glad.

A Merry Christmas.

The Glare of the Streets

The "glare of the streets" is at this season of the year a common expression. It indicates, however, an undesirable condition, for glare should be avoided always. Where for the time being an accepted old-fashioned system countenances, or again, where unskilled application of modern lighting units emphasizes it, early steps should be taken toward its elimination. Street lighting systems with all the wonderful improvements now employed are, in this respect, still far from perfect. Automobile, street-car and interurban car headlights, still pierce the darkness as a positive danger. Glaring store window lighting destroys our confidence in the merchant who uses it. Certainly the glare of the streets is undesirable.

Where street lamps are of greater brilliance than surrounding objects and installed at too low heights

above the sidewalks, they destroy their purpose by decreasing the ability of the eye to see. The great brilliancy of headlights temporarily destroys the visual function, besides being hurtful. It is at such times that the false step is made and an accident results. In store window lighting, inability to see clearly results from improper installation—a blinding effect produced rather than an illumination of the goods.

Comparatively but a few years ago it was then positively dangerous to walk abroad at night, and street lighting had its inception in an endeavor to minimize this danger. But in overcoming the dangers then existing, the pendulum has swung far over, and in the present day practice the danger lies in the lighting appliance wrongfully used.

When street lighting electrically was first considered the inventor had in mind the erection of a high tower and the use of a high-power source which would diffuse a light over all the city.

With the increased efficiency and the consequent increased intrinsic brilliancy of present-day lamps, it would appear that the present system of low mounting heights will become still more unsatisfactory and greater mounting heights be again sought. Perhaps some new method of indirect illumination of streets will be developed, for such an ideal contains untold possibilities. Its realization would do much toward removing that which is now undesirable in street lighting.

In considering this subject one fact stands out patent: That if the streets are well lighted, vehicle headlights are not necessary; that on well-lighted streets these headlights should be dimmed or altogether extinguished, or else be replaced with low candlepower sidelights. Accidents innumerable have resulted from the use of these powerful headlights. Not only have pedestrians suffered, but the drivers of the cars themselves become confused both by the brilliant light from approaching cars and in automobiles and from light also reflected in the wind shield by cars coming up from behind. It would be in the interests of all to have their selfish and inconsiderate use abolished.

For the glareless lighting of store windows reliance must be had on the honesty of purpose both of merchant and contractor. But an aroused public opinion insistently demanding all these improvements will be the surest method of effecting their complete accomplishment. The glare of the streets must go.

Engineering Education

This is the age practical in which that man is considered best educated who is most useful. The standard by which present day education is measured is utility. The industrial power and commercial standing of a nation—the community greatness—is an expression of the efficiency of its people.

Forms of civilization change, the essentials of those past but a consideration in those now existing. Now is emphasized the importance of industry, trade and commerce. Efficiency dominates these, and into all activities the work and counsel of the engineer has found its welcome and necessary place. The engineer of to-day is a product of the age practical.

But the term "engineer" has become too broad in its application to express properly the highest standing of that profession, for from the man who runs an engine, on past those who make it, then to those who design it, and up to the originator and discoverer of its principles, all are called by the same name. In other departments of engineering and its allied occupations, the same looseness exists. It is as though the pathfinder who discovered or determined the road, the men who made and those who traverse it, should all be called "pioneers."

Generalization in discussing engineering education is difficult unless it is limited to the education of those who will later be professional engineers of the highest order—"real engineers who will discover and determine and otherwise adapt the resources of nature to the efficient service of man."

Education of whatever kind is not that which is imparted to a man, but is a measure of the efficiency which he evidences.

The aim of engineering education should be efficiency; the providing of exceptional skill and knowledge and the faculty for complete and easy accomplishment.

The ramifications of engineering activities are complex and the requirements of engineering education therefore diverse. Engineering education should, however, constitute a cause which, properly applied, must result in right action. It should be founded on the fact that the engineer must be well-grounded in fundamentals. Physical principles, and principles of economics, psychology, logic, money and banking, sociology, ethics, commercial law and business, are among those considered essential. In addition, he must have initiative, pluck, perseverence and poise and self reliance.

Let a man be firmly principled in his profession and he will succeed ever, be the problem never so complex.

A further report of the Oregon Society of Engineers made to the President and Members of the Board of Higher Curricula of that State upon this subject of engineering education appears in this issue. It is impossible for such a discussion to be provincial, for it is of national importance, for engineering education has to do with those individuals through whom perhaps more than any others the community greatness of the nation is realized.

The pages of experience from the practical field should prove an invaluable aid to educational boards and commissions in establishing courses which loyally and intelligently prosecuted, will produce men so equipped as to be most useful to the engineering profession.

The college professor and educationalist from whom the final solution of this problem of determining the most efficient method of engineering education must come has also much valuable information to contribute. A nation-wide discussion, aided and coordinated by a central authority such as the Society for the Promotion of Engineering Education, would aid in simplifying this problem, the satisfactory solution of which would make for a further increased individual efficiency and consequent national supremacy.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

J. D. Hanna, manager Cleveland Car Company, is at Salt Lake City.

G. Douglas Jones, electrical engineer, state of California, is at San Francisco.

H. R. Noack, president Pierson, Roeding Company, was at Los Angeles during the past week.

J. H. Newlin, purchasing agent San Joaquin Light & Power Company, is at San Francisco.

W. Arnstein, president Oakland, Antioch & Eastern Railroad, has returned from an Eastern trip.

Wm. Henning, superintendent Desert Water Power Company, Kingman, Arizona, is at San Francisco.

H. C. Goldrick, Pacific Coast manager Kellogg Switchboard & Supply Company, is at Los Angeles.

Robert E. Wirsching has been appointed to the Board of Public Utilities, Los Angeles, to succeed **O. O. McReynolds**.

S. C. Lindsay has been elected chairman of the Seattle section American Institute of Electrical Engineers and **E. A. Loew**, secretary.

T. E. Bibbins, Jas. G. Pomeroy, H. E. Sanderson and **Miles F. Steel** have just been appointed Statesmen-at-Large of the Jovian Order.

Hal Lauritzen, Holophane Works of General Electric Company, San Francisco, is away on a business trip to Salt Lake City and Denver.

W. E. Dunn, director Los Angeles Railways, has been elected president of the corporation until the return of **H. E. Huntington** to Los Angeles.

Sidney Sprout, general superintendent and **O. G. Steele**, superintendent Siskiyou district California-Oregon Power Company, were at San Francisco last week.

Henry H. Sinclair, vice-president, Centerville Improvement Company, Los Angeles, has been transferred to the grade of member of the American Institute of Electrical Engineers.

John Salberg, salesman in the Denver office of the Westinghouse Electric and Manufacturing Company, returned to Salt Lake City last week on account of the heavy snows which prevented him from getting into Denver.

J. Paulding Edwards, consulting engineer, Sacramento, Cal., and **E. F. Scattergood**, chief electrical engineer, Bureau of Los Angeles Aqueduct Power, Los Angeles, Cal., have been transferred to the grade of Fellow of the Institute, A. I. E. E.

Frederic S. Burroughs, chief engineer, Public Service Commission of Washington, Olympia, Wash., and **Max Hebgen**, vice-president and general manager Montana Power Company, Butte, Mont., were elected members of the American Institute of Electrical Engineers.

T. T. Richards has been appointed assistant sales manager of the Wagner Electric Manufacturing Company, St. Louis. Mr. Richards has been associated with the Wagner Companys sales department for nine years, specializing in the marketing of the new devices produced by this company.

C. B. Vorce, construction engineer British Columbia Electric Railway Company, has completed a three years contract with that company and expects to leave shortly for San Francisco. The record of his accomplishments during the contract period is splendid and have been favorably commented upon by visiting engineers.

H. B. Miller, Thomas C. Burke, Professor F. G. Young, of the University of Oregon, are members of the Oregon Hydroelectric Commission together with **Professor T. A. H. Teeter** of the Oregon Agricultural College; **J. F. Watt** of Hood River; **W. H. Graves**, president of the Oregon Society of Engineers; **J. V. Tallman** of Pendleton; **H. L. Vorse** of Portland; **John McCourt** of Portland; **William Hanley** of Burns; **C. A. Park** of Salem; **T. H. Burchard**, president of the Oregon Federation of Labor; **Mrs. Clara Waldo**, of Macleay; **W. D. D. Dodson** of the Chamber of Commerce, and a representative from the State Grange to be appointed.

Richard M. Boykin, Washington-Oregon Corporation, Portland, Ore.; **Robert K. Buzzell**, Hobson & Gillies, Vancouver, B. C.; **Wm. Hockley**, industrial engineer Western Canada Power Company, Vancouver, B. C.; **Sidney W. Huson**, electrician Hobson & Gillies, Vancouver, B. C.; **Wm. F. Kelly**, district manager Canadian Tungsten Lamp Company, Ltd., Vancouver, B. C.; **Geo. F. Kenyon**, electrical engineer Hobson & Gillies, Vanvouver, B. C.; **Walter Langdon-Davies**, electrical engineer, B. C. Electric Railway Company, Ltd., Vancouver, B. C.; **Sherwood C. Lindsay**, electrical engineer, Seattle Electric Company, Seattle, Wash.; **Ralph Waldo McNeill**, electrician, Utah Copper Company, Garfield, Utah; **Frank G. Milligan**, operating engineer, Seattle, Wash., and **William J. Murphy**, chief electrical inspector, Edmonton, Alta, have all been elected Associate Members of the American Institute Electrical Engineers.

MEETING NOTICES.

Seattle Section A. I. E. E.

The December meeting of the Seattle Section was held on Tuesday evening, December 16th, in the Chamber of Commerce, Central Building. Mr. John R. King of the Puget Sound Traction, Light & Power Company, presented a paper on electrically driven vehicles, the discussion of which was participated in by several men engaged in the vehicle business.

At the November meeting, report of which was delayed, Mr. L. C. Lindsay read a paper entitled "The Use of Protective Relays on Power Systems."

Oregon Electrical Contractors' Association.

The Oregon Electrical Contractors' Association held its regular meeting at the Commercial Club at 6:30 o'clock Wednesday evening, December 10th, when much time was devoted to the discussion of the new bookkeeping system being compiled by the National Electrical Contractors' Association.

Jovian Electrical League of Southern California.

The regular meeting was held at Christopher's Los Angeles, on December 17th. The chairman of the day was Mr. Carl Johnson. An address on "One of Los Angeles' Greatest Needs," was read by Mr. Volney S. Beardsley. The meeting was adjourned on account of the holiday season, to meet again on January 7, 1914. Many applications have been received for the Jovian Rejuvenation to be held in January which it is expected will be a record-breaker.

Oregon Society of Engineers.

On Thursday evening, December 11th, the Oregon Society of Engineers held a regular meeting at the Public Library Building, Portland, Oregon. Mr. Robert S. Edwards was to have given an illustrated talk on "Concrete Roads," but on account of his unavoidable absence from the city this was postponed and instead, Dr. Lazell gave an interesting talk on "The Manufacture of Portland Cement," followed by Mr. Ralph Modjeski who gave a short description of the new bridge he designed and which is now being constructed across the St. Lawrence River at Quebec, Canada.

California-Oregon Electric Power Company's Club.

The California-Oregon Power Company Electric Club meeting was held in the club rooms, Electric Building, Med-

ford, Oregon, on the evening of December 12th. The subject discussed was "Warehouse and Supply Business," and short papers were contributed by H. L. Walker, Sidney Sprout, G. B. Conwell, O. G. Steele, O. O. Alendorfer, J. D. Linnott, R. R. Ebel, F. O. Shason, J. J. Buchter, J. M. Chamberlain, H. C. Stoddard, E. G. Henselman, Don Colvig, C. L. Clevenger, F. F. Loder and C. A. Malone. A dinner in keeping with the holiday season was also served.

Utah Electric Club.

The regular weekly luncheon of the Utah Electric Club was held in conjunction with the Commercial Club, the Manufacturers' Association, the Native Sons, the Associated Ladies' Clubs, and other civic organizations of Salt Lake City, in observance of Utah Products Day, December 10th. Lon J. Haddock, of the Extension Department of the Agricultural College, was the principal speaker, and pointed out the economic advantages to all of the commercial interests of the state to use "home-made" products when they are available. The Electric Club had installed a sign over the tables which had been reserved in the main dining room of the Commercial Club for it, with the words, "Utah Electric Club," outlined in incandescent lamps. The club was congratulated by the various organizations present for its enterprise in providing such a novel feature for the occasion. It was announced that the first annual ball of the Club will be held at the Odeon Dancing Academy, Friday, December 19th.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The railroad commission rendered a decision granting authority to the Spring Valley Water Company to issue $1,000,000 of notes for the purpose of liquidating indebtedness and for carrying on work on Calaveras Dam.

The Pacific Light & Power Corporation applied for authority to issue $1,730,000 of bonds. The proceeds are desired for sinking fund payments and the refunding of indebtedness.

A decision was rendered granting authority to the Mt. Whitney Power & Electric Company to issue $250,000 of bonds.

A decision was rendered granting authority to Griffin's Transfer & Storage Company of Los Angeles, to issue $72,000 of stock and $50,000 of bonds for new equipment.

The Winters Gas Company was granted authority to issue $21,300 of stock for the purpose of building a gas plant in Winters, Yolo county.

A revised and reduced schedule of freight rates was put into effect in the Sacramento Valley on the Southern Pacific Company.

NEWS OF THE RAILROAD COMMISSION OF OREGON.

Four other physical connection cases between unrelated telephone companies have been decided by the commission and in each of these there were points of differentiation.

In the case of the First National Bank of Albany, Oregon, et al., against the Pacific Telephone & Telegraph Company, the bank sought to secure connection of its private intercommunicating system with the defendant company. The commission declined to order this connection, finding that as the bank is not a public utility it does not come within the purview of the law.

In the case of Henry Chappelle, owner of a telephone exchange in the city of Woodburn, Ore., against the United Telephone Company, which operates exchanges at Hubbard and Woodburn, the commission found that public convenience would be served by interchange of business between the plaintiff's exchange and the defendant's exchange at Hubbard, and directed such connection to be made, each company to pay the other five cents on each call originating on its line and carried over the other's lines.

Finding that the territory served by the Chehalem Mutual Telephone Company and the Newberg Telephone Company is substantially the same, and that active competition exists between them, the commission refused to order a connection on the complaint of the company first named, holding that no public necessity exists for such interchange. This is without prejudice to future complaint if the Newberg company fails to adequately supply the territory.

Dismissal of the complaint was ordered in the case of the Plainview Telephone Company against the Pioneer Mutual Telephone Company, the commission finding that the plaintiff's property consists of a number of rural telephone lines that do not come within the definition of a public utility.

TRADE NOTES.

General circulation seems to have been given a report that Ray D. Lillibridge, New York, will give up his advertising business and take up exclusively the exploitation of some California interests. Mr. Lillibridge states that this is not the case and continues: "It is true that we contemplate opening an office in San Francisco next year to take care of the interests of some of our clients in anticipation of and through the Panama-Pacific Exposition, but we have no idea whatever of abandoning our present location nor of making it subordinate to the new one."

A fire in the building at Second and Howard streets, on December 15th occasioned some inconvenience to the Exide depot and storeroom of the Electric Storage Battery Company and the warerooms of the Benjamin Electric Manufacturing Company, both of whose business offices are in the Rialto Building. The battery company has rehabilitated its former quarters and announces that but slight delay will be caused in filling orders, while the Benjamin Company has secured temporary ware rooms in the Telephone & Electric Company Building at New Montgomery and Howard streets.

NEW CATALOGUES.

The Lighting Studios Company, New York, has issued a serviceable catalogue in loose-leaf form listing their unique lines of illuminating glassware.

Data on Brookfield Insulators is being mailed by the Brookfield Glass Company, New York. The mailing card also contains a postal which will bring their complete catalogue No. 51 on request.

Sprague Electric Works of General Electric Company, New York, have issued Bulletin No. 247 describing in detail their round type motors and their application. Complete data is given and many uses illustrated.

Electric Household Appliances for Cooking and Miscellaneous Purposes is the title of a seasonable bulletin issued by the Simplex Electric Heating Company, Cambridge, Mass.

The Wagner Electric Manufacturing Company, St. Louis, is mailing a miniature reproduction of their Single-Phase Converter Bulletin No. 103. This brings it into more convenient size for the pocket, is convenient for mailing and advantageous to the man on the road.

Economical Steam Production is the title of a bulletin issued by G. L. Simonds & Co., Chicago, Ill. It deals with the elimination of soot and the resulting plant economies. Complete information is given, but provision is also made for those desiring still more specific data.

The General Electric Company's Bulletin A4131 describes Storage Battery Locomotives. The bulletin outlines the general conditions under which the use of such locomotives are desirable or advantageous, and illustrates and describes various devices and sizes which have been built and placed in service. The bulletin is accompanied by a data sheet for the use of those who wish further information.

PACIFIC COAST GAS ASSOCIATION.

(The following discussions are abstracted from the proceedings of the Pacific Coast Gas Association, 1913. The subheads are the names of the papers discussed, all of which have appeared in previous issues of this journal.—The Editors.)

Gas Company's Public Policy.

H. F. Keyes:—The trouble, as my experience in Sacramento for all these years shows, has not been altogether the public. I will give you one instance to demonstrate. Our wonderful city commission under our form of government made up their minds that they had to do something for the dear people, and they advertised that they were going to make rates on a certain day. They are supposed under our charter to make the rate in February, but there was going to be an election on the 15th of May, I think it was, and about the 8th of May they made up their minds that they had to reduce the rate. They advertised in both papers that the public was invited to appear at this meeting for making the rates, together with the representatives of the different corporations that were there, and register any complaints that they might have. I attended that meeting and how many of the dear public do you suppose was there? Not a single soul to make a complaint. But on top of that our commissioner of public works informed me that they had to do something. First he figured that he would make our rate 75 cents instead of a dollar. He spoke to one prominent member of the state railroad commission. In the meantime the state railroad commission had their expert to go over our accounts, and knew perfectly what we were doing, and they told him it was impossible. Then he said, "Well, we will make it 90 cents," and this member of the railroad commission says it would not be worth the paper it is written on. But they had to do something, and so they made the rate 95 cents and necessitated us to go to the United States Court to protect ourselves and put us to a great expense. I said to the gentleman when we tried to get them to rescind this ordinance, "I will ask you one fair question. All I want to know is what figures you used in determining the rates you have made for us in Sacramento." They did not say anything, except one of them turned around and said, "We just thought you were making money enough." He did not take the time to examine our annual report. It was politics and it is politics in nearly every instance, and you find that notwithstanding the public are absolutely satisfied, these officers think they must do something to hold their offices. I think you will find that obtains in nearly every city. It does in Los Angeles to a great extent and I think where the managers and the trouble men, as the gentlemen from Fresno said, go out and mix with the people as we have always tried to do in my corporation, you will find that your troubles will be very small. It will never do to say, "To Hell with the public," and if the different people that have the management of the different companies will get out as this gentleman says and mix with the people, you will do more to pay dividends to your stockholders than anything else.

Modern Gas Distribution and the Part Played by the Automobile.

D. E. Keppelman:—There are no limitations to the welding game. We weld about everything made of steel. This is an elegant opportunity to bring out the old conditions of welding and what we are learning today. We started with the generator on the ground. This has been entirely eliminated and we are now using a cylinder gotten out by the commercial acetylene people. You can get any size tank you want, from 100 ft. to 500 ft., costing you 2 cents a foot. Generated on the ground it would cost you approximately 1 cent a foot; but with generating you can't move the generator each and every time that you weld. It necessitates the running of half or three-quarter inch pipe for several hundred feet, with a great loss of gas, together with the troubles and difficulties experienced in moving the generator. We find that the commercial acetylene gas in tanks at 2 cents a foot is a great deal more economical.

In conjunction with what Mr. Leon Jones told you that we were doing with distributors, the hole is burned into the pipe with the same torch that does the welding. On 6 or 8-inch pipe that would probably take you from 20 to 30 minutes to cut with a cutter. It is done in 2 or 3 minutes with a torch and it is cut perfectly. The welded joint on 8-inch pipe, labor and material, which includes acetylene and oxygen and the labor of welding and handling the pipe and throwing it in the ditch, and lining it up and testing and so forth, is done today at 83½ cents a joint, a saving of more than a dollar on each and every joint, and that is only covering the initial installation. The cost of the outfit—we have used two kinds of torches. The first torch was a very good torch. It was a German patent. The regulation of the oxygen and acetylene was done with merely one arrangement—one control. That we found to be a very good torch for a beginner in getting his welded, joints tight. After a while, when we became a little more experienced we found that the torch that had two controls, one on both the gas and the acetylene, was more economical, because we got a better mixture, saving considerably on both the acetylene and the oxygen. The cost of the torch is approximately $35. The rubber tubing necessary, two lengths of 50 ft. each, about 9 cents a foot. The acetylene cylinder we use is the 500 ft. size, which will cost you approximately $136, including the freight to San Francisco, The oxygen tank of 100 ft. capacity, which is all you will require, is $130. Oxygen today will cost you 2½ cents a foot. It is well and safe to figure at all times, with our practice today, a proportion of 1¼ of oxygen to 1 part of acetylene. The gauges necessary to cut down the pressure on your tanks range from 250 to 300 pounds down to a working pressure of 16 pounds on your oxygen and 4 pounds on your acetylene, and is approximately $25 a gauge. That includes all of your outlay.

The joints were given out by contract on our first installation and they wanted $5 a joint. We finally got it at $4 and later at $2.50 a joint. That same joint, 8 inches, which cost $2.50 under contract, we are doing today with our own man who is paid $3.75 for 8 hours, at 83½ cents a joint, including labor, material and so forth. Oftentimes the pipe is pitted, which will cover your electrolysis case, and that is about the easiest thing we do. The holes 2 inches in diameter in small pipe which would almost take out the arc of the pipe is covered up completely. That would take in the same work where we burn a hole in the pipe and insert a socket, practically building a boss on the pipe. I don't know of any case where we have had to build up a hole larger than 2 inches. We have made an experiment wherein we had 150 pounds pressure on the line, on testing, and we found a leak. As an experiment we endeavored to weld with the pressure on. It can't be done. The pressure when released enlarged the hole to about 2 inches. That was very nicely filled up and after the second test it was perfectly tight.

[To be continued.]

INDUSTRIAL

WESTERN WATER COMPANY PUMPING PLANTS.

Prompted by the urgent need of the oil fields, a corporation was organized to supply water for boiler, drilling and domestic purposes to the largest oil field in the world, known as the "Midway." This field was at that time being supplied with boiler and drilling water from deep wells situated near Maricopa, Twenty Five Hill, Fellows, and McKittrick, Cal., but this contained so much sulphur and salt that it could not be used for domestic purposes. The Kern Midway Water Company furnished the domestic water and transported it in tank cars 48 miles from Kern City. This water sold in the fields at

Pumping Station No. 1, Western Water Company, Taft, Cal.

20 cents per barrel. This company sold water to the Twenty Three and the Railroad Water Company, who in return distributed it through small pipe lines to their various customers.

In March, 1911, property was secured near the point where the Kern River turns into the lake, and about 12 miles from the oil fields. A test well was drilled and pumped continuously for six days to establish, without a doubt, the quantity and quality. Water suitable for both domestic and boiler purposes was found in abundance.

The plan was to install pumping machinery of sufficient size to pump 2,000,000 gal. per day to a storage tank on the highest hill in the field, known as Twenty Six Hill, and distribute by gravitation.

In July 1911, the company ordered 12½ miles of 12 in. 49 lb. plain end pipe, and sufficient had been received by October 1, 1911, to start laying it. This pipe is coupled with Dayton couplings, a style of coupling consisting of a body ring and two ring flanges, through which bolts are fitted and when drawn up, compress a ring of packing against the outside surface of the pipe, thus making a perfectly water tight joint. The use of this type of coupling facilitates repairs in case of leakage or damage to pipe line due to washouts, caused by heavy rains in the hills.

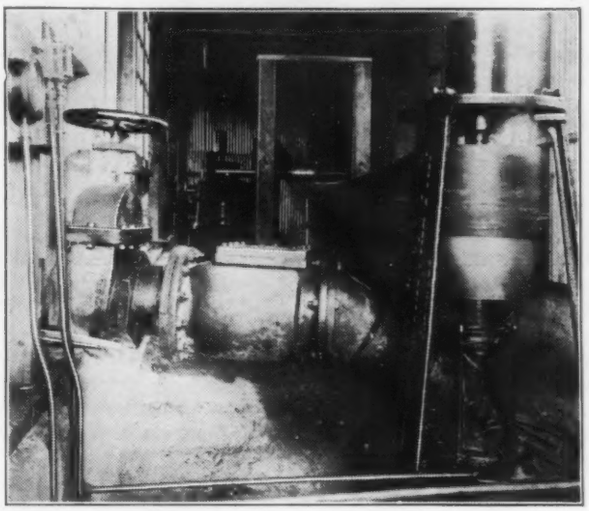
Pumping machinery for the two stations was ordered in July and arrived in September, 1911.

Station No. 1 is located near the water wells, and the machinery consists of two No. 7 Layne & Bowler vertical turbine pumps, the capacity of each being about 2,000,000 gal. per day. These two pumps are driven by one 50 h.p. Fairbanks-Morse single cylinder horizontal type engine for pump in well No. 5 and one 80 h.p. Fairbanks-Morse 3 cylinder vertical heavy duty gas engine for pump in well No. 7.

The elevation at the surface of the ground where these pumps are installed is 297 ft. above sea level. When not being pumped the water in the wells raises and runs over the top of the casing. When being pumped to the full capacity of the pumps, the water is lowered only about 58 ft.

The water from these pumps is discharged into two 10 in. pipes, which connect to Y branches on the 14 in. discharge line leading to the concrete reservoir 672 ft. distant.

The reservoir is 40x100 ft. x 5½ ft. deep, divided into two basins 40x50 ft., so that one side can be emptied and cleaned without interrupting the water supply.



No. 7 Layne & Bower Vertical Turbine Pump. Driven by a 50 h.p. Fairbanks-Morse Horizontal Oil Engine.

The water first enters a sand box or settling basin before flowing into the reservoir, which prevents sand and silt from entering the 20 in. suction pipe leading to the 9x18 F.-M. power pumps in the main building. The elevation on the floor of this building is 310½ ft. Water is thus supplied to the pumps under slight pressure.

The equipment in the main building consists of three 9x18 Fairbanks-Morse pot valve power pumps, direct connected to three 250 h.p. Fairbanks-Morse four cylinder vertical heavy duty engines.

The gas for use in these engines is supplied from the Taft to Bakersfield pipe line of the California Natural Gas Company.

The pumps are fitted with 10 in. discharge pipes, which connect to the Y branch fittings on the 12 in. main line to Station No. 2 in Taft.

Each pump is fitted with a relief valve set at 550 pounds. The line pressure when plant is in operation being from 500 to 525 lb. per sq. in., 300 lb. of which is static and 200 to 225 lb. caused by friction in the pipe. There are also four alleviators on the main line at this point to take care of any water hammer that may occur.

All Y branches, gates and other fittings were placed in pipe line and tested to 1000 lb. per sq. in. hydraulic pressure.

The main building, 50x95 ft., is a substantial frame structure, covered with corrugated iron. The roof trusses are built to carry a load of two tons on the traveling crane, which is fastened to them. The crane was provided for the handling of heavy pump and engine castings, if necessary. The floors are concrete.

The power developed at this station is approximately 600

h.p.; the average consumption of gas per month is 5,500,000 cu. ft. Lubricating oil consumed averages 200 gal. per month. The oil is pumped from the crank case of engines to filters, and from there gravitates to the tanks that supply the oiling system.

For auxiliary equipment there is an electric lighting plant to light all the buildings; the engine of the light equipment also drives an air compressor which charges six receiving tanks.

Three 100 h.p. Titusville Tubular Boilers and Two 18x18½x18 Fairbanks-Morse Duplex Pot Pumps

The compressed air is used for starting the large engines, and by its use any one of the 250 h.p. engines can be easily started by a single operator.

There is also a refrigerating plant of one ton capacity, a machine shop containing lathe, drill press and pipe threading machine, etc., a blacksmith shop and a garage, also an oil house, where all waste oil is collected and filtered; also a heavy press for squeezing the oil out of wiping rags.

The 12 in. main line from Station No. 1 to Station No. 2 is laid in a direct line and crosses two ranges of hills, known as the Elk Hills, elevation 539 ft., and the Buena Vista Hills, elevation 1026½ ft. The lowest point is in the valley between these hills, with an elevation of 306 ft., this being 4 ft. lower than the floor of the No. 1 power house.

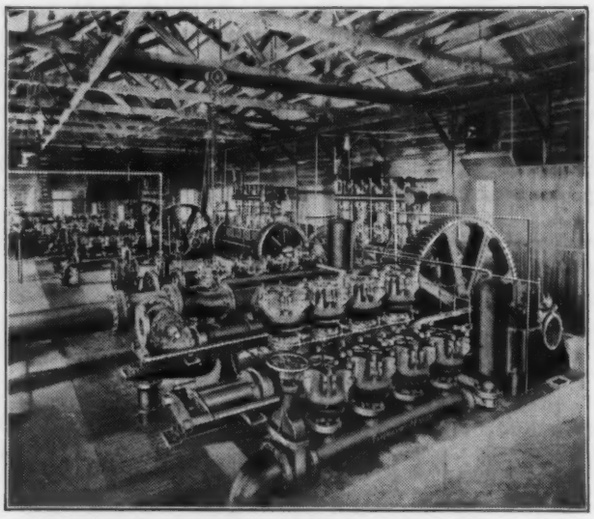
Station No. 2 receives the water coming through the 12 in. line from Station No. 1 in a 5000 bbl. tank near the power house.

The machinery in Station No. 2 consists of three 100 h.p. Titusville horizontal tubular boilers and three temporary 40 h.p. fire box boilers, one 18x6x18 Fairbanks-Morse Coalinga pattern pump, and two 18x18½x18 Fairbanks-Morse duplex valve pot pumps. The fuel used at this plant is natural gas, furnished by the California Natural Gas Company, and amounts to about 6,000,000 cu. ft. per month. This station is also equipped with a 6½x8 Rumsey triplex power pump driven by a 50 h.p. Fairbanks-Morse induction motor.

The structure which houses this machinery is a substantial wooden frame, and is covered with corrugated iron. The floors are of concrete, and all suction and discharge pipes are laid beneath the floor surface and the openings are covered, but all are of easy access.

The location of the company's property at Station No. 2 adjoins the city of Taft on the north. Water is discharged from the large line pumps in this station into a 12 in. manifold, to which is connected the 8 in. line, which discharges the water into the 55,000 bbl. storage tank on Twenty Six Hill, a distance of two miles. Another 8 in. line connects into this manifold, which supplies all of the lines of the Kern Trading & Oil Company; still another 8-inch line is connected, which supplies all the North Midway field. This line is of 8 in. pipe for a distance of seven miles, where it connects to six miles of 6 in. pipe.

The South Midway line is constructed of 8 and 6 in. pipe, and is nine miles long. It connects into all of the lines of the Kern Trading & Oil Company. The water supply in the city of Taft is furnished by the Consumers Water Company, who purchase water from the Western Water Company. The connection for this supply is also made at the station.



Three 250 h.p. Fairbanks-Morse Gas Engines, Direct Connected to Three 9 x 18 Fairbanks - Morse Valve Pot Power Pumps.

A new 8 and 9 in. line is now being constructed which connects into the 12 in. main line at a point 10 miles from Station No. 1, where the elevation is 730 ft. This line will supply Buena Vista Hills and the territory known as the Maricopa Flat. The length of this line will be 12 miles.

The elevation at Station No. 2 is 980 ft. 6 in., and at the 55,000 bbl. storage tank it is 1643 ft. At the extreme end of the North Midway line the elevation is 1272 ft. At Shale it is 1284 ft., and at Fellows 1294 ft. At the end of the South Midway line the elevation is 654 ft.

The system was completed in December, 1911, at a cost of over one-half million dollars, and the first water was delivered after six months of actual construction work—December 18th of the same year.

An unusual feature in connection with the operation of the system is that no trouble has been experienced with either machinery or pipe line. The 250 h.p. gas engines at Station No. 1 have operated continuously on an average of twenty-six 24-hour days a month for 20 months, and the 50 h.p. single cylinder engine pulled a load amounting to 60 h.p. for a period of 10 months.

The Western Water Company supplies water to approximately 60 per cent of the Midway-Sunset Oil Fields, the total acreage supplied is 30,720 acres of oil land. The water is sold at 3c per bbl., whereas heretofore operators have paid from 6c to 20c per bbl. At the present time 35,000 bbl. of 42 gal. each are being delivered daily.

The Western Water Company has proven itself successful both from a financial standpoint and for the purpose of its incorporation—that of supplying water to the largest oil field in the world, where the supply had heretofore been inadequate and spasmodic, causing immense damage through interrupted work from the lack of water at a critical time during the drilling of wells, etc. In the northern end of the field development had practically stopped because no water was available. The price of water was, in many instances, cut 50 per cent to 75 per cent.

NEWS NOTES

INCORPORATIONS.

LOS ANGELES, CAL.—Pacific Electric Car Company, $10,000, subscribed $30 by J. C. Wormley, H. D. Hattel, C. H. Van Velsor.

SAN FRANCISCO, CAL.—Central Electric Company, $10-, 000, shares $100 each, subscribed $300, by W. P. Smith, H. S. Ripley, B. B. Blake.

HOMEDALE, IDAHO.—Homedale Water, Light & Power Company has filed articles of incorporation for general business here. Capital $150,000. C. M. Hill, D. F. Sullivan, Otto Zimmerman, H. D. Gee and S. H. Clawson are the incorporators.

ILLUMINATION.

DILLON, MONT.—Residents of this city are considering the installation of a street lighting system in which electroliers will be used.

BUTTE, MONT.—A contract has been signed with the Montana Power Company for an ornamental street lighting system in the business section. Work is to be completed by July 1, 1914.

HUNTINGTON BEACH, CAL.—Inventory of the electric light plant of the Huntington Beach Company is being made with a view to its purchase by the Pacific Light & Power Company, which is to supply electricity to Newport Beach and whose lines are now at the city limits of Huntington Beach.

PORTLAND, ORE.—The Underwriters' Equitable Rating Bureau has directed the attention of all municipal electrical inspectors in the state of Oregon to the necessity for additional care in inspection during the holiday seasons that all decorations be installed electrically safe and the possible dangers thereby eliminated.

OREGON CITY, ORE.—Plans are being made and a preliminary survey has been started by the Portland Gas & Coke Company for a pipe line which will connect this city with the plant near Linnton. It is probable that the new line will go through Sellwood, Milwaukee, Gladstone, and end at Oregon City. The exact route has not been chosen.

SAN FRANCISCO, CAL.—A resolution calling upon the City Engineer's office for a comprehensive plan of street lighting at once economical and efficient, directing especial attention to preserving the rights of the city in making installations of new lights so that they can be turned over to the city eventually at the least cost, was adopted by the supervisors.

TRANSMISSION.

SAN FRANCISCO, CAL.—The commission has authorized the Pitt River Power Company to operate in sections of Shasta, Modoc and Lassen counties if the company obtains satisfactory franchises in the counties named.

SAN BERNARDINO, CAL.—The Pacific Electric Company will build two new power houses at once, one to be located in San Bernardino and the other in the vicinity of Etiwanda. Contracts for construction of these will be let in the near future. Both buildings will be of reinforced concrete construction.

SAN FRANCISCO, CAL.—An ordinance giving the City Electric Company permission to string wires and erect poles in the Exposition grounds without a franchise, has passed the supervisors on the recommendation of Supervisor McCarthy of the exposition committee. It is similar to others agreed upon giving extraordinary powers to the Exposition company during the life of the World's Fair.

PORTLAND, ORE.—The Oregon Hydroelectric Commission, which had its inception in a plan advanced at the commonwealth conference at the University of Oregon last spring, held its initial meeting at the Portland Chamber of Commerce Saturday, December 13. The purpose of the commission is to arrange for funds to conduct a world-wide study of electric power and the methods and cost of its production and application to manufacturing industries, with the view to formulating a basis on which the vast waterpower resources of Oregon may be developed. The plan for the commission was suggested by Professor F. G. Young of the University of Oregon, and State Engineer Lewis.

AUBURN, CAL.—The Pacific Gas & Electric Company, by its attorney, John M. Fulwieler of this city, has filed papers in a suit of condemnation against J. L. Rollins, Thos. E. Morgan, J. C. Hawyer and Dan Kirby, as trustees of the Erie Mining Company to have the land covered by certain mining claims on Bear River, near Colfax, condemned for a dam site. The ground wanted by the Pacific Gas and Electric Company is located just above the head of the Bear River ditch in Nevada and Placer counties, extending up to the mouth of Little Greenhorn Creek, and the claims would be subject to flooding during high water stages, when the natural flow of Bear River would be augmented by 15,000 miners' inches of water pouring into the river from the newly installed power house at Drum, which is brought from the Yuba River at Lake Spaulding.

OROVILLE, CAL.—According to reports received here from Big Meadows the work of the Great Western Power Company of filling in the earth dam above the concrete dam in Big Meadows is nearing completion. About 200 men are still employed on the works, and the operations will be continued to a limited extent through the winter. The dam will be rip-rapped with heavy rock and the spillway will be constructed of concrete. As it now stands the bulwark has a base of about 600 feet and stands 62 feet high. No attempt will be made, it is reported, to install a power plant just below the dam on the north fork of the Feather River for several years, as the immediate purpose for which the dam will be used is to store sufficient water in order that the flow in the north fork may be equivalent through the summer months, thus giving sufficient water for the development of more electric energy at the Big Bend plant, where two additional units are now being constructed.

LOS ANGELES, CAL.—A contract between the city and three power companies in Los Angeles is being drafted by City Attorney Stephens that is expected not only to be approved by the City Council, but accepted by the power companies. This statement is based upon the successful termination of negotiations between the City Attorney and counsel and officials of the power companies. The contract provides the following definite propositions: (1) The city to lease the distributing systems of the power companies for a period of five years. (2) The power companies to sell to the city at the end of that time at a price to be determined by an appraisement of the State Railroad Commission. (3) The city and power companies to supervise the operation of the municipal distribution system under the direction of a board of control composed of three members named by the city, three named by the companies. It is proposed to have the city make all extensions to the power systems, to unify the service and to make all preparations to take over the entire system at the end of the leasing period.

TRANSPORTATION.

GLOBE, ARIZ.—The city council has revoked the Amster franchise for an interurban electric line between Globe and Miami, insofar as it effects streets of Globe.

LOS ANGELES, CAL.—Fire destroyed the Pacific Electric car barns at Sherman a few days ago, causing damage of $25,000, which was little more than value of the barns.

DIXON, CAL.—After a long discussion on the matter of the applications of the Northern Electric and Sacramento Valley railroads for a franchise in this city in which representatives of both roads and citizens took part, it was decided to grant both the roads a franchise for the use of a joint track.

FRESNO, CAL.—The financing of a new electric interurban line from Fresno to Academy by way of Clovis, to tap a hitherto uninvaded fruit and mineral territory of the foothills, is assured, according to F. S. Granger of Fresno, promoter of the enterprise. Mr. Granger is well known as the promoter of the interurban electric railroad from San Jose to Los Gatos and to Saratoga Springs. This line, originally twenty-seven miles in length, is now being extended to Palo Alto.

SAN FRANCISCO, CAL.—With the acquisition of the Presidio and Ferries Railroad the mileage of the municipal lines is doubled. More new lines are being projected. One that is to cross Golden Gate Park at Tenth avenue, going out Kirkham street to Forty-fifth avenue and thence to Sloat boulevard, promises to give the residents south of the park the transportation facilities they have long been demanding. These lines, with the ones to be built with the proceeds of the recent bond election, will give San Francisco the nucleus for a transportation system of considerable proportions.

OAKLAND, CAL.—At a recent meeting of the stockholders of the San Francisco & Oakland Terminal Railways, two-thirds of the stock was represented. W. A. Bissell, president of the company, presided. The meeting was called for the discussion of the project of raising the bonded indebtedness of the company from $20,184,000 to $21,184,000. The stockholders agreed to the project, and it is expected that the bonds will be used as collateral. This is the first of several steps to be taken in the settling of the affairs of the company. These will be discussed at another meeting set for December 23.

TELEPHONE AND TELEGRAPH.

MALAKWA, B. C.—It is reported that a company will be formed here to install a local telephone system.

EMPIRE, CAL.—The Empire Telephone Company has applied to the commission for a certificate of public convenience and necessity to operate in and about Empire, Stanislaus county.

RIVERSIDE, CAL.—Bids will be received up to December 29th, for a franchise granting right to construct and maintain telephone and telegraph wires over streets and public places in this city.

TERRA BELLA, CAL.—The Deer Creek Rural Telephone Company applied to the commission for authority to sell its plant located at Terra Bella, Tulare county, to the Pacific Telephone & Telegraph Company.

EDMONTON, ALTA.—In the neighborhood of $2,000,000 will be expended by the Alberta government on telephone extension work during 1914. This will include the erection of a large number of exchanges.

SAN RAFAEL, CAL.—The Pacific Telephone & Telegraph Company has just completed its new telephone line to McNear's Landing. This additional equipment will feed the Uplands Tract, Bayside Acres, Mt. Venice, San Francisco Quarries Company and Daniels Contracting Company, connecting these points directly with the San Rafael exchange.

VANCOUVER, B. C.—It is reported that the Dominion Government contemplates constructing a new wireless station on Chatam Point, midway between Cape Lazo and Alert Bay. This is the only section of the British Columbia coast not covered by wireless system. With its establishment steamers plying up and down the coast between Vancouver and Prince Rupert will at all times be in touch with wireless stations.

SAN FRANCISCO, CAL.—Supervisor Hilmer of the Telephone Rates Committee has called the attention of the public to the fact that if the telephone rate ordinance is sustained by he federal courts subscribers will be refunded all charges the company is collecting in excess of the rates fixed by the supervisors. He gave this warning because of the efforts of certain persons to secure contracts from subscribers to collect refunds on a percentage basis. The company is keeping two accounts with consumers and will make the refund voluntarily if the court decision is adverse to it.

STOCKTON, CAL.—Within a few months the Pacific Telephone & Telegraph Company will expend about $50,000 through the Stockton offices to improve its long distance service throughout the San Joaquin Valley. Three thousand dollars will also be spent to install additional equipment in this city to increase the efficiency of the local service. The work on the valley improvements will be started about the first of the year. Two more circuits will be installed between this city and Modesto, and four additional long distance wires will be run between Stockton and Fresno, touching Modesto, Merced, Madera and other points along the line, 250 miles of wire.

VANCOUVER, B. C.—The new Canadian government telegraph line connecting Vancouver with Newport, the terminus of the Pacific & Great Eastern Railway, is open for commercial business. The line connects at Newport with a 47-mile telephone line into the interior, constructed by the contractors of the Pacific & Great Eastern Railway, and when eventually completed to Lillooet will connect with the recently completed government telephone line from that point to Lytton, on the main line of the Canadian Pacific Railway, giving service to the ranchers of the Fraser Valley. Before completion of the line to Newport the only method of communication with that point was by daily boat.

WATERWORKS.

SUNNYVALE, CAL.—The people of this city have voted to incur a bonded indebtedness of $75,000 for sewer and water systems.

SANGER, CAL.—Two bond propositions carried by a large majority; bonds for a sewer system were for $30,000 and for the water system $32,000.

SEATTLE, WASH.—Water system franchises have been granted to the Lake Forest Light, Water & Power Company and to the Lakota Water Company.

VICTORIA, B. C.—The city council has awarded the contract for the concrete flow line for the Sooke waterworks to the Pacific Lock Joint Company. The amount of the tender is $329,760.

TUCSON, ARIZ.—Bonds in the sum of $165,000 to be used in improving the city water system in accordance with plans prepared by the city engineer, have been voted by the people of Tucson.

TACOMA, WASH.—The city council has voted to install water mains in the Fern Hill District at an estimated cost of $23,878. This improvement included about four and one-half miles of mains.

LOS ANGELES, CAL.—Judge Myers of the superior court has authorized Col. Holabird, receiver for the California Development Company, to enter into a contract to supply the owners of 4000 acres of land in Imperial valley with water.